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Rallus mirificus Parkes and Amadon, type. One-half natural size.
Painting by Lloyd Sandford.

A NEW SPECIES OF RAIL FROM THE PHILIPPINE ISLANDS

BY KENNETH C. PARKES AND DEAN AMADON

ALTHOUGH Mayr (1957:35) predicted that no more than 20 good species of birds would be found in the decade following 1955, the rate at which such discoveries have been announced in the past few years suggests that Mayr's figure may well have been too low. Some of the new species turned up in recent years have reposed in collections, unrecognized, for a long time. Most of the rest have either been small, inconspicuous passerines, easily overlooked, or have come from remote mountains or jungles, attainable only by major expeditions.

Among a collection of some 900 birds from the Philippine island of Luzon, purchased jointly by Carnegie Museum and the American Museum of Natural History in 1959, we were astonished to find no fewer than seven examples of what appears to be a new species of *Rallus*, three of which were taken in the immediate vicinity of a town situated on a main road, only about 50 miles from the city of Manila. In view of the surprising nature of such a discovery, it seems appropriate to call the new rail

Rallus mirificus[1], new species

Type: American Museum of Natural History no. 708,000; adult female; Santa Fe (Dalton Pass), near Aritao, Nueva Viscaya Province, Luzon, Philippine Islands; collected November 20, 1958, by A. Concepcion.

Description of Type (Capitalized color names from Ridgway [1912]): Crown and nape Chestnut-Brown, lightening to Chestnut on hindneck, near Auburn on forehead; a narrow line of Sayal Brown between forehead and lores; lores and cheeks Deep Olive-Gray washed with Chestnut-Brown, paling through Light Olive-Gray to white on throat; anterior back near Brussels Brown, darkening toward Prout's Brown on posterior back and rump; feathers of anterior back with vaguely-defined blackish central areas which do not reach tip; feathers of mid-back with small black-bordered spots of Pale Pinkish Buff along edges, these spots decreasing in both size and abundance anteriorly and posteriorly; scapulars Brussels Brown, the edges of the feathers with black-bordered bars of Pinkish Buff; upper tail coverts and rectrices somewhat blacker than Mummy Brown, with small black-bordered marginal spots of Pinkish Buff; breast Deep Gull Gray, heavily washed with Brussels Brown on sides of breast, less heavily across upper breast; center of abdomen Pale Gull Gray; sides Prout's Brown, darkening posteriorly through Mummy Brown to a blacker color (but not black) along flanks, all of these feathers being heavily barred. The bars range from Pale Pinkish Buff anteriorly to Light Pinkish Cinnamon posteriorly, and are narrowly bordered with black.

[1] Latin, "causing wonder."

Toward the sides of the abdomen, the ground color of the feathers approaches Deep Grayish Olive, with whiter bars lacking the black borders. Under tail coverts Olivaceous Black, broadly tipped with Light Pinkish Cinnamon. Larger upper wing coverts like scapulars, smaller chiefly Brussels Brown; small feathers along bend of wing white; inner secondaries Brussels Brown, becoming blacker toward center of feather, with prominent black-bordered marginal bars of Pale Pinkish Buff or Pinkish Buff, best developed on outer margin; primaries and outer secondaries very dark brown, almost black, the latter with a few small Pinkish Buff spots along outer margin; under wing coverts Olivaceous Black, mixed with white. Soft-part colors in life probably about as shown in Mr. Sandford's painting (frontispiece), judging from comparison of dried parts with those of related species for which color notes are available.

Variation in Color: There are minor variations in shade, particularly of the reddish brown of crown and neck, among three of the four presumed adult specimens. The fourth, a female from the type locality, is markedly darker and richer in all of its shades of brown, and has fewer and smaller bars on wings and scapulars. Its flanks are somewhat blacker, although not the pure black of *Rallus pectoralis*.

Three specimens are assumed to be immature individuals. They lack the decided reddish-brown color of the crown and hind neck, being various shades of dark grayish brown in these areas, and are grayer on the cheeks and upper breast. Their bills also appear to have been darker in life than those of the presumed adults.

Range: Known only from two localities in the western foothills of the southern half of the Sierra Madre Mountains of Luzon, Philippine Islands: Papaya, Nueva Ecija Province (about 50 miles north of Manila), and the type locality, near Aritao, Nueva Viscaya Province, about 70 miles north of Papaya.

Relationships: The new species appears to be most closely related to *Rallus pectoralis* Temminck, a species ranging from Flores in the Lesser Sunda Islands to New Guinea, Australia and Tasmania. All races of *pectoralis*, however, have the back conspicuously streaked with black, a condition only vaguely suggested by the dark central area of the basal portions of back feathers of *mirificus*. In all races of *pectoralis* the reddish brown of the head and hind neck is much brighter and more reddish than in *mirificus*, and in most races is more or less heavily streaked with black, continuous with the black streaking of the back. There is no suggestion of such streaking on the head and neck of *mirificus*. In all races of *pectoralis* the barring of the abdomen and flanks is crisply black and white rather than dark brown and buffy as in *mirificus*. Judging from the color of dried bills and from informa-

tion recorded by collectors of *pectoralis* (soft-part color notes are unfortunately not available for *mirificus* at this time), the bill in all races of *pectoralis* is more extensively red, and of a paler color, than that of *mirificus*. The toes and tarsi of *mirificus* also appear to be darker. The bill of *mirificus* is proportionately shorter than that of any race of *pectoralis* (see measurements, beyond).

Of the known subspecies of *Rallus pectoralis*, the closest approach to *mirificus* in appearance is shown by the two small-billed races, *exsul* Hartert from Flores, and *insulsus* Greenway from northeastern New Guinea, both known only from their respective type specimens. Both *exsul* and *insulsus*, however, are clearly races of *pectoralis* (although *insulsus* was originally described as a race of *Rallus striatus*, which is quite a different species), having the pale bill, streaked back, and black-and-white barring typical of *pectoralis* as a species. The streaks on crown and hind neck, prominent in some races of *pectoralis*, are only faintly indicated in *exsul* and *insulsus*, but are completely absent in *mirificus*.

TABLE 1

MEASUREMENTS OF *RALLUS MIRIFICUS* AND *RALLUS PECTORALIS* (IN MM.)

Specimens	Wing (flat)	Culmen from feathers	Tarsus	Middle toe and claw
Rallus mirificus ad. ♀ (TYPE), Santa Fe, Luzon, P.I., Nov. 20, 1958	108	27	30	37
ad. ♀, Santa Fe, Luzon, P.I., Nov. 18, 1958	106	25	29	36
ad. ♀, Papaya, Luzon, P.I., Nov. 16, 1958	106	26	29	38
ad. ♂, Santa Fe, Luzon, P.I., Nov. 18, 1958	—	24	28	35
imm. ♂, Papaya, Luzon, P.I., Nov. 16, 1958	107	26	30	37
imm. ♂, Papaya, Luzon, P.I., Nov. 16, 1958	106	25	28	33
imm. ♂, Santa Fe, Luzon, P.I., Nov. 19, 1958	103	25	29	34
Rallus pectoralis exsul ad. ♂ (TYPE) South Flores Island	100	27	29	36
R. p. insulsus ad. ♀ (TYPE) Wau, New Guinea	99	27	29	34
R. p. alberti ad. ♂ Angabunga River, New Guinea	92	30	32	37
R. p. captus ad. ♂ Mount Hagen, New Guinea	100	35	34	41
R. p. mayri ad. ♂ Kofo, Arfak, New Guinea	104	39	34	39
R. p. pectoralis ad. ♂ Victoria, Australia	104	33	30	35
R. p. brachipus ad. ♂ Tasmania	103	31	31	39

Rallus mirificus and *R. pectoralis* may form a superspecies, but the clear-cut differences between them, the remoteness of their ranges, and the absence of representative forms elsewhere, leave little doubt that they are specifically distinct.

The widespread Oriental and East Indian species, *Rallus striatus*, occurs side by side with *mirificus* on Luzon, and is superficially similar to it. *Striatus*, however, is a larger bird, with a much stouter bill, heavier tarsi and toes, a heavily spotted back, and *barred* flight feathers, among other differences.

Measurements: See Table 1. Judging from other specimens in the same collection, the sexing of the *mirificus* specimens may not be completely reliable. Measurements of various races of *Rallus pectoralis* are appended for comparison. Note that in *mirificus* the culmen length is 25% or less of the wing length, in *pectoralis* 27% or more.

We are grateful to J. C. Greenway, Jr., of the Museum of Comparative Zoölogy, for permission to examine the unique type of *Rallus pectoralis insulsus*.

Literature Cited

Mayr, E.
1957 New species of birds described from 1941 to 1955. *Jour. für Ornith.*, 98:22-35.
Ridgway, R.
1912 Color standards and color nomenclature. Washington, D.C.

CARNEGIE MUSEUM, PITTSBURGH, PENNSYLVANIA; AND AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK, NEW YORK, OCTOBER 12, 1959

THE SONG, NEST, EGGS, AND YOUNG OF THE LONG-TAILED PARTRIDGE

BY DWAIN W. WARNER

So little is known about the habits and distribution of the Long-tailed Partridge (*Dendrortyx macroura*) that a summary of my observations on a few of the facets of the life of this species may be of interest. The nest and eggs have not been described.

The only detailed information on any of the large Middle American forest quail is that by Skutch on the Marbled Wood Quail (*Odontophorus gujanensis*) (1947. *Condor*, 49:217–232), to which the reader is referred for descriptions of similarities, as well as differences, between that species and *Dendrortyx macroura* in habits, voice, nest, and eggs.

The following observations were made during the period from September, 1953 through July, 1954, in the region of the Lagunas de Zempoala which lies on the border between the Mexican states of Morelos and Mexico and the Distrito Federal. The weather in this high and extremely rugged region, which borders the Balsas drainage system, is one of drastic and rapid changes through much of the year. The months of February to late April are dry, and few clouds gather over the mountains. Days are sunny and warm and the nights pleasantly chilly. This is the season of forest fires which, along with cutting, have altered the primeval beauty of this magnificent mountain forest of fir, pine, and oak in which there is a strong admixture of more characteristically lowland flora on the south-facing slopes.

During the months of December, January, and February frost occurs nearly every night. From May through the rest of the year clouds shroud this mountain mass most of the time, and mist and rain fall nearly daily. During the rainy months there occur severe thunderstorms which often culminate in light to heavy falls of hail, or "graniso," to depths of several inches. On June 29, 1954, snow accumulated to a depth of four inches over most of the Sierra de Ajusco above 2900 meters, of which Zempoala is a part. At dawn cold air which settles over these highlands during the night pours as a strong wind southward off the highlands toward the lowlands of Morelos.

In the mountains about the Valley of Mexico the Long-tailed Partridge, or "gallina del monte," is still fairly common in the least disturbed humid forests of fir–pine–oak at an altitude between approximately 2800 meters and 3300 meters. The species is very shy and, from my experience, extremely difficult to approach without a dog. It is both arboreal and terrestrial but spends much time on the ground, as indicated by extensive scratchings in the leaf litter and humus of its shaded home. On the other hand, flowers, flower buds, and fruits

are eaten from perches above ground in much the same manner as in the more arboreal species of grouse.

This quail is hunted successfully by only a very few people, who nearly always use a dog. I remember watching in amazement the first time a Mexican hunting companion heard quail. He quickly laid down his gun, removed his huarachos and all of his clothing except undershorts; then retrieving his gun, and beckoning to his silent dog, he disappeared without a sound into the forest. In about five minutes the dog barked; and nearby a quail flew from the ground to a branch about 15 feet above the ground, where it was shot.

The voice of this quail is seldom heard. Loud calling or singing began in late February, but these calls were heard only rarely even during the period from February to July, so that presence or absence of these birds in an area could not be determined by their vocalizations. No calling was heard other months of the year. I never heard more than two outbursts of song in one day in one area; and songs were heard only just after dawn and at dusk.

From a distance, as across a valley, the song is a loud, ringing *korr-EEE-oh, korr-EEE-oh, korr-EEE-oh, korr-EEE-oh,* which is taken up by other individuals in the same area, as well as by others in other places. Singing may continue for some 30 seconds to a minute, then cease abruptly, leaving no clear clues as to directions from which the songs really came or the numbers of birds involved. This is not the complete song but is really only the end. When singing birds are near the observer, a series of introductory notes are heard which begin as low, guttural, hooting sounds which rise rapidly in volume until the *korr-EEE-oh* sounds start without pause. These preliminary notes may be indicated best as *whoop, whOop, whOOp, whOOOp, WHOOOP, korr-EEE-oh,* etc. The two parts of the song are so different that it is difficult to believe at first that they are part of the same song. Mexicans who hunt this quail learn of its presence by other sounds unfamiliar to me.

Groups of adults apparently come together at feeding and dusting grounds even during the nesting period, and singing heard in July involved more than two birds in one small area.

Two adults were taken in steel traps set for large mammals in forest trails, and tracks were seen along trails, indicating that this quail may use trails in much the same manner as the Marbled Wood Quail reported by Skutch (*loc. cit.*). (See Fig. 1.)

Gonadal changes in adults, and observations on a nest, eggs, and young give some clues to breeding time and habits. A male taken in November had a left testis measurement of 8 × 4 mm. Testes of two males collected in February and early April measured 10 × 3.5 and 10 × 6 mm. The ovary of a female collected on April 20 had undergone considerable recrudescence, and the oviduct was approximately 5 mm. in diameter; and a female collected on June 21 had a soft-shelled egg in the oviduct, and 10 oocytes in the ovary ranging from 5 to 15 mm. in diameter. No brood patch was apparent on this bird, but

some feathers of the lower breast and belly were being replaced. Two downy young in early postnatal molt found June 6, and reports of young as early as late May show that nesting begins by late April or early May.

Two adult males weighed 450 and 455 grams; two adult females weighed 374 and 446 grams. The digestive tract of one bird contained flowers, flower buds, small green fruits and seeds. Others contained similar vegetable matter and arthropod remains.

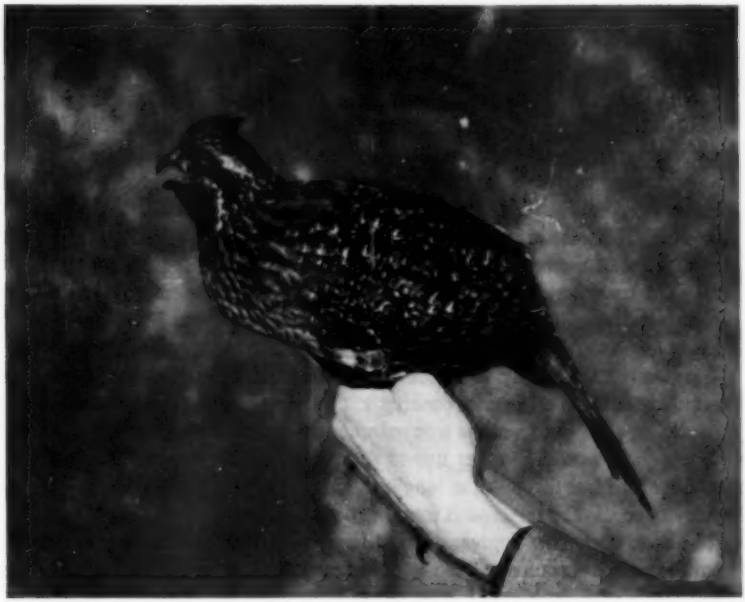

FIG. 1. *Dendrortyx macroura* calling near Huitzilac, Morelos.

A nest with its clutch of eggs was found about four kilometers northwest of the village of Huitzilac, Morelos, along the road to the Lagunas de Zempoala. There the road skirts the Cañada de Oclacingo, which plunges away to the south from the slopes of Cerro Cuautepetl. The nest was located about one-half kilometer across the canyon in semi-open fir–pine–oak forest at an altitude of about 2900 meters. The slope at the nest site was very steep. Three hundred feet below the nest was a small level area planted in corn. Soil on the slope was very shallow with much rock exposed, but in most cases only the outward facing sides of the rocks were bare or were lightly covered with moss and

lichens. Soil cover consisted of a little leaf mold, much pine duff, and a few leaves.

The vegetation was dominated by tall, mature firs and pines, among which were a few gnarled oaks. The oaks were largely dead, and were covered with epiphytic mosses, lichens and other plants. All of the mature trees showed much fire damage. Many young trees 15 to 20 feet in height were present with firs growing in dense clumps dominating this stratum. Except in the clumps of fir, there was a dense growth of broad-leaved shrubs nearly everywhere. Two species of ferns were abundant as ground cover, and grasses were present in small scattered openings in the forest.

The nest was located eight feet west of two oaks, 50 feet tall, standing close together. At this site there was a rather open tangle of brush, at the base of which dead branches lay prostrate on the ground. They jutted out from a two-foot-high rock exposure so that some touched the ground several feet out from the base of this vertical exposure of rock. A matting of twigs, pine needles and leaves had accumulated several inches thick on the prostrate branches. This matting, impervious to light and probably to rain, formed the sloping roof of a cavity three or four feet long and two feet wide at ground level. The inner wall was formed by the rock face. In this cavity was the nest to which the birds had access through a single opening about six inches wide at a slight angle outward from the rock side at the northeast end of the cavity.

Leading to the cavity entrance were two obvious trails, both probably created by adult quail in approaching and leaving the nest. One of the trails extended straight out from the nest entrance toward the two oaks for a distance of about three feet. The other turned sharply from the entrance and extended for about five feet through the tangle of twigs and brush at the lower edge of the cavity roof. The latter path was the more heavily used.

The nest, a shallow depression well lined with fine grasses, lay 12 inches from the cavity entrance and close to, but not touching, the rock wall. Only a small part of the dark cavity was occupied by the nest. Up to a distance of eight feet, and only from near ground level, all that could be seen of the bird on the nest was the bright red bill.

At 3:00 p.m. on July 1, when Allan R. Phillips, two other companions, and I visited the nest site, one adult quail was sitting on the nest. The bird remained there for about five minutes while we watched and took photographs. When we had approached cautiously to within eight feet, the bird quietly left the nest by the "switch-back" path, and disappeared in a few seconds. The nest contained six eggs, two of which were collected. Cesáreo Jimenez reported that at 4:00 p.m. on the previous day the nest had contained only four eggs and that an adult was on the nest. "Several" days before that, in the afternoon, only two eggs were present, and an adult was on the nest.

The two eggs which were collected were fresh. Each weighed 28.3 grams; they measure 49.0 × 33.4 and 48.5 × 33.5 mm. In color they are pale cream and are lightly and evenly spotted with light brown, the spots being of varying sizes with the larger ones nearly one millimeter in diameter. (See Fig. 2.)

When we visited the nest three weeks later, all that remained were scattered feathers of an adult quail, broken egg shells and a distorted nest cavity.

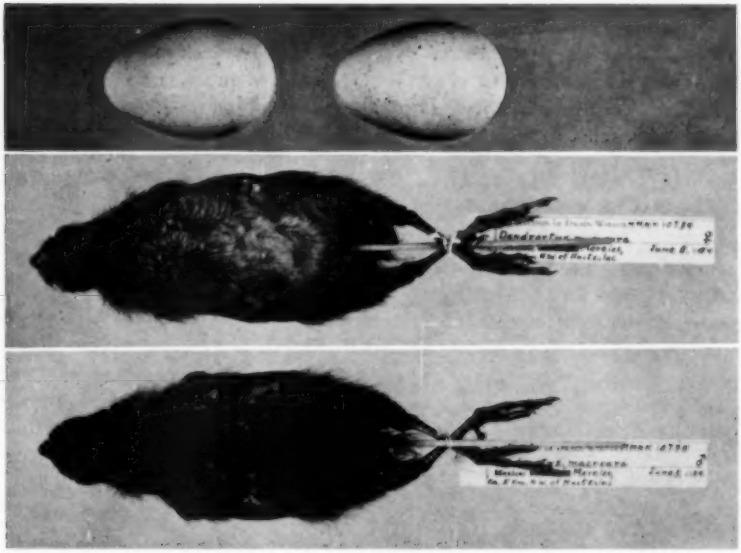

FIG. 2. Eggs and young of *Dendrortyx macroura*.

On June 8, 1954, I obtained in Huitzilac two live young, a male and female, which had been found together two days before on the south slope of Cerro Cuautepetl at an altitude of about 3000 meters. Both are in natal down except for some juvenal feathers among the interscapulars, scapulars, and on the wings and sides of the breast and belly. The wing of the male measures 51 mm. in length. On each wing only seven primaries could be found, and the No. 1 secondary had not appeared. In life the eye was olive-gray. The tip and anterior tomial region of the upper mandible, and the anterior two-thirds of the lower mandible were light orange-red; the rest of the bill was blackish. The tarsi and toes were light orange-red, darker posteriorly on the tarsi and on the soles. (See Fig. 2.)

Apparently the juvenal plumage has not been adequately described. Ridgway and Friedmann (1946. *U. S. Nat. Mus. Bull.*, 50, pt. 10, p. 246), in describing the juvenal plumage of *D. m. diversus*, state that this plumage is similar to the adult plumage with a few minor qualifications. Although the specimens at hand are in early postnatal molt, enough of the juvenal plumage shows both dorsally and ventrally to indicate that this plumage is similar in basic pattern to that in other Odontophorinae. The most obvious characters of this plumage are in the pattern of the breast, belly and back where the white shaft streaks expand near the tips, forming large V's or broad white bars at the ends of the feathers. The rest of the feather is blackish in the middle and browner at the base, the brown extending farther out on the lateral sides of the feathers of the back. The over-all impression, then, is of a spotted or barred young bird which is very different from the adult.

MINNESOTA MUSEUM OF NATURAL HISTORY, UNIVERSITY OF MINNESOTA, MINNEAPOLIS 14, MINNESOTA, JULY 11, 1958

NEW LIFE MEMBER

Ormsby Annan, a graduate of Harvard University (A.B.) and Northwestern University (M.S. and Ph.D.), is now a member of the teaching faculty of Barat College, Lake Forest, Illinois. Dr. Annan is interested in external and internal influences on the annual cycle of birds, and in educational nature photography. He is a member of the A. O. U., Cooper Ornithological Society, Ecological Society of America, and state ornithological societies of Illinois, Iowa and Florida.

LIFE HISTORY NOTES ON THE LEAST TERN

BY IVAN R. TOMKINS

IT is amazing how one small mite of song in our vast complex of saline marshes, rivers and beaches, can mean so much. Absent, it is not missed, but when suddenly it is heard again after a time without it, one senses that something was missing before but now everything falls into proper perspective and there is order and beauty again—an order that is like a framework, incomplete in detail to let imagination have sway, yet comforting in its integrity. We may now and then fit some odd-shaped bit into the framework, to be tested by later observation. Fragments gleaned from the writings of others may tentatively bridge some of the gaps, yet there is always room for imaginative thought, controlled imagination fully heedful of possible errors in our own work, or in our interpretation of what others have written. The picture will always be incomplete, for however much we learn, there are still things to be added without end.

When April and May bring the cheery notes of the Least Tern (*Sterna albifrons*) creaking overhead, one more piece of the summer scene fits into place. Smallest of the terns, diminutive, elegant, immaculate in its white and gray and black plumage, it will dive for fishes close to our boat, drift directly overhead at close range, sit on the railings of bridges where cars pass frequently, or make its nest close to habitations or human activities if conditions suit. On the nesting grounds it will dive within a few feet of one's head, then return to the eggs while the intruder is only 50 feet away.

There have been two times when the species was numerous in this locality (Savannah, Georgia), once in the 1880's and again in the 1920's and '30's. There also have been two lows, the first within the years from 1890 to 1920, the second in 1957.

Erichsen (1921) stated that since 1891 no eggs of this species had been taken in Chatham County, Georgia, but quotes Troup D. Perry that they nested in large numbers on the five miles of sandy beach of Warsaw (Wassaw) Island from 1885 to 1890. Erichsen began the study of birds as a young man about 1909. Perry was then 59 years old. Gilbert R. Rossignol began his egg collections in 1904, and was active from 1907 to about 1937. All three were friends and competent observers.

From Rossignol's egg record it appears that he did not find any Least Terns nesting until his first visit to Oysterbed Island (he called it Robinson's Island) on June 7, 1922, but on that day he collected 55 sets of Least Tern eggs, and some sets of Wilson's Plover (*Charadrius wilsonia*) eggs. Oysterbed Island was not large enough above tidal level to furnish suitable habitat for a

large colony, until a few years before the 1922 visit. In the 1880's it did not exist.

These data are not extensive, yet the evidence of great fluctuations needs to be presented, not only for present understanding, but also to guide observations in the future. I wonder if similar things have happened in other parts of the range. About the turn of the century such things were usually blamed on the plume hunting. Perhaps other factors were operating too.

In the 1920's and 1930's, this species was very abundant along the coast of Georgia and South Carolina, and it was believed that it was making a strong comeback after the slaughter for millinery purposes was outlawed a few years before. Today this tern's numbers have fallen off greatly, and the reason is not at all clear. Certainly human predation is not now the cause. In 1925, by conservative estimate, 2500 pairs nested on Oysterbed Island in the Savannah River Entrance. This island was sandy, relatively barren of vegetation, and about 3000 feet by 6000 feet in dimension. As this is written in the late summer of 1957, I doubt if there are 200 pairs in Chatham County, and the small colonies under observation have not been successful in rearing replacements for the aging birds. About one-half of the possible tern habitat in the County was covered by me in April, May, and June, and trips were also made into portions of Sapelo Sound, and throughout the Altamaha Sound, farther south along the Georgia coast. Everywhere I have been the tale is the same, a few nonbreeders and a few small colonies of nesting birds.

In those early days on Oysterbed, there were some low dunes with an abundant population of *Rattus rattus*, all of the color phase we knew as the roof rat, and many house mice (*Mus musculus*). We never found definite evidence of predation on the terns or their neighbors, the Black Skimmers (*Rynchops nigra*) and the Wilson's Plovers. The chicken snake (*Elaphe obsoleta*) was also present, but no visible predation was noticed. The island was sufficiently isolated so that the mink (*Mustela vison*) and the raccoon (*Procyon lotor*) did not readily reach it. Avian predators were not greatly different from those today.

Oysterbed was built up by the dredging of spoil from the nearby channel, and, if left alone, vegetation soon made it untenable for the terns, skimmers and plovers, but the deposit of fresh sand renewed the habitat. About 1930 a hydraulic fill about three miles long was completed connecting Oysterbed with Jones Island, an 800-acre island to the westward which was largely salt marsh. This furnished a highway for numerous raccoons and minks which prowled the fill to and from the island nightly. Meanwhile, vegetation tended to extinguish the habitat. The birds took up habitation on clear ground at various points on the fill and appeared quite successful for several years, though there are no data on the number of young birds that reached the flying stage. In the

following years harbor improvements created barren sand heaps at various places along the harbor, and the terns and plovers moved sparingly onto these grounds. Small colonies of terns became established inland for about 20 miles, a few plovers nested as far as 15 miles from the Entrance, but the skimmers did not accept nesting grounds beyond the inner end of the fill.

The Mississippi Valley race (*Sterna albifrons athalassos*) nests on sandbars north to Sioux City, Iowa (DuMont, 1934), but our coastal race does not follow the river into the River Swamp. In recent years I have made several summer trips on the Savannah River from the Fall Line to Savannah, and would have seen the birds if they were present. There are numerous sandbars uncovered during the season of summer low water, and there are small fish near the surface for food.

After some time I became aware that these small tern colonies of 15 to 30 pairs were not very successful in their nesting. Some of the trouble was attributed to the Fish Crow (*Corvus ossifragus*), and it was thought that a small colony did not have an adequate defense, and that the attrition by the daily forays of the crows soon caused abandonment of the site. Many times these small groups of terns selected a site, made nests, and laid a few eggs; then after a little time their numbers began to lessen, and finally the site was deserted. In a colonial species like this, it may be that the mass stimulus of certain numbers is necessary before the birds can reach and maintain the proper emotional state for satisfactory nesting. It is not practical to detail here all of the shifting of populations and population centers from the late 1930's to date, even if adequate data were on hand, but now it seems that the decline started with the breakup of the large group on Oysterbed Island, or possibly a few years later when vegetation on the other side of the river began to inhibit nesting there. The last successful nesting of the skimmers at the Entrance was on Oysterbed in 1949, following the deposit of fresh sand in 1948, though it is not known how many young birds were reared. For the next two summers, 1950 and 1951, the skimmers and some Royal Terns (*Thalasseus maximus*) tried to establish a colony well up along the fill. In late May they assembled and prepared nests, but deserted the site by mid-June. At present I know of no skimmer colony in Chatham County.

Though there is clear evidence of a large decrease in numbers over the past 25 years, it cannot definitely be blamed on raccoon predation. This year one unsuccessful colony, whose eggs usually disappeared within a few days after they were laid, had raccoon tracks everywhere. Of all the vertebrates common to this area, the raccoon is the most probable one to have much effect on the terns where the ternery is close to the marshes. Trapping of fur-bearing animals was more intensive during the depression years, and has been less so

since about 1940, due to the fuller employment of those who would otherwise be trappers.

High tides and heavy squalls may also almost wipe out certain colonies. When a squall drops two or three inches of rain in an hour or so, the sand is easily eroded; eggs are buried or washed away; and even the immediate landmarks that may serve to orient the birds to the individual nests may be changed. Sometimes the terns will dig the sand out from around the partly buried eggs if they are left in place, and resume incubation, but if the eggs are separated by only a few inches, the bird will not roll them together again. Years ago there were small colonies on the outer beaches near the high water line, but these were vulnerable at times of high spring tide or storm tide.

Sprunt and Chamberlain (1949) give a glowing account of the prosperity of the Least Tern in the Charleston area. The finding of several small colonies is not evidence of adequate replacements, and I do not know how valid their account would be today, in the light of the status in Georgia. It probably would have been true some years ago.

When a species of relatively long life is declining in numbers due to poor success in the season of reproduction, the condition may not be noticed for some years. Gilbert R. Rossignol had one return of a banded bird at five years of age, and another at ten years. This is scant information as to longevity, but all that is at hand.

A few single birds are often seen foraging miles from any colony, and sometimes three to six pairs may take up on some suitable location, go through a part of the courtship activities, and perhaps even dig a few nest scrapes; but these are probably nonbreeders, perhaps too immature or for some other reason unable to carry through the full nesting cycle.

Timing of Arrival, Egg-laying.—The time of arrival in spring is quite consistent, about April 18 to 20. Courtship begins immediately, and appears to take about 20 days. The first eggs are usually laid about May 7, and from then on fresh eggs may be found at nearly any time up to about the middle of July. There is no indication of two broods; to my mind, the long period of feeding young (to be described later) precludes that. It appears instead that there is much destruction of eggs from one cause or another, even in a highly successful colony, and that the population consists of pairs of birds in various phases, psychologically and physically, of the regimen of the season of reproduction. It has been stated often that, when the nest or eggs are destroyed in any species, the pair goes back to some prior stage in the seasonal pattern. I have found some nests occupied for a week or more after the eggs disappeared, but in no case have I known fresh eggs to be laid there again.

By the end of July there may remain a few young birds still grounded, but most of them are awing, and the colony may be nearly deserted, the main body

of the terns moving to various beaches, sandbars, beds of dead oyster shell, and the like. The numbers diminish about September 1, and by the middle of the month all are gone. There are a few individual birds to be seen later, yet to my thought these few laggards are of little importance in the general scheme.

Courtship and Mating.—There is little indication of pair-formation when the spring migration occurs, but courtship is initiated soon after, and within a week the members of a pair seem to recognize each other by voice, for a resting female will often take off on hearing the notes of an approaching male. The courting grounds are quite independent of the nesting site, and may be miles away. Unlike the Common (*Sterna hirundo*), Gull-billed (*Gelochelidon nilotica*) and Royal Terns, all of which species are engaged in courtship activities when they pass through here in spring, the Least Tern prefers an elevated place near the river bank, rather than an open beach. An old log near the river, the piling tops of the river dikes, the concrete railing to bridges —these are the favored places. One spring the dredge, which was my office and home, worked close by some permeable dikes with flat-topped wooden pilings. For days the females sat on these pilings, apparently not fishing for themselves, accepting the food brought by the males who often mated with them there after the acceptance of some small fish or shrimp. Often a female would fly from her perch and there would ensue a series of flights, quite like the "fish flights" described by Palmer (1941) in the case of the Common Tern, but I have been unable to assign meaning to many parts that to his view seem significant, such as the "straight position," the "bent position," the "aerial glide," the "parade," and so on, though there is great similarity in his description to what takes place in this species.

Courtship feeding is one of the most significant parts of the courtship and is continued through the incubation period; though the complete ceremony which culminates in copulation and the ritual in general become abbreviated as the pair progresses into the median and later stages of the season of reproduction. Much has been written of courtship feeding, but it seems to me that too little emphasis has been given to the transition from the feeding during courtship to the feeding of the incubating female, and finally the bringing of food to the young brood. The symbolic offering of other objects has been mentioned in the literature, as the offering of sticks by the Black Skimmer (Pettingill, 1937). It is widespread among birds. The Osprey (*Pandion haliaetus*) will bring sticks to its incubating mate, who weaves them into the nest structure which becomes enormous in time. The Blue Jay (*Cyanocitta cristata*) brings nesting material and sits quietly nearby until its mate takes it to use in building the nest. The Herring Gull (*Larus argentatus*) in first winter plumage will pick up and carry around sticks, offering and refusing them to others in the flock. Perhaps the small bits of shell that ring the nest

of the Least Tern are such symbolic offerings. When the male brings a fish it may be passed back and forth between the pair a time or so before it is eaten.

The female signifies her readiness to mate by crouching and quivering her wings. The male stands beside or a little behind and turns his head rapidly to right and left for some time. The female also turns her head from right to left but not as much as the male. After mounting the female, the male continues the head-turning for a little time before copulation. The ceremony is distinctive, and has been seen many times.

FIG. 1. Male Least Tern carrying food to incubating female.

Incubation and Eggs.—The birds of the pair have been seen to relieve each other in incubating the eggs, yet it would not do to postulate equal sharing of this duty—if one may apply such a word—when the furnishing of a greater part of the food by the male in courtship, and probably later on, is considered. Certainly the male brings much of the food during some of the incubation period (Fig. 1). It can readily be observed in any colony at this time.

The eggs (size, color, etc.) have been well described in the standard works, and here it can only be pointed out that there is great variation in color, size of spots, etc., within the clutch of eggs. Some lack any warmth of color, others possess much of it. The downy young in the nest exhibit the same variation, some nearly pure gray and white, others with much reddish or brown in the coloration. It had been planned to photograph some variant sets in color, then follow through when the chicks were hatched to see if egg color and that of the downy plumage were related, but the lack of success of the 1956 season prevented this.

The habit of the incubating bird of leaving the nest, flying out over the water and plunging, then returning to shake off the water drops on the eggs, has been discussed elsewhere (Tomkins, 1942). Murbarger (1956) reported the same behavior in the White Pelican (*Pelecanus erythrorhynchos*). The loss of water from the eggs by evaporation might be considerable in very dry times. I have seen the American Oystercatcher (*Haematopus palliatus*) stand beside the nest and not cover the eggs in rain.

Foods and Feeding.—One habitat requirement is an ample supply of small fish or shrimp that swim close to the surface, for this species does not dive

FIG. 2. Least Tern bringing one fish to feed young.

deep nor accept large fishes. Though many thousands have been seen carrying food, it is doubtful if any of the fish have been much over 60 mm. long. When the large colony was nesting on Oysterbed Island, individual birds had a maximum range of 16,000 feet from which they carried food to the colony, though the food nearby was ample and daily replenished by the tides. The terns carry only one fish at a time (Fig. 2), mostly small slim fish of several species, and it must take a lot of flying, even at a median distance of one and a half miles, to satisfy the growing young (Fig. 3). On the other hand the Black Skimmer often feeds to the young fish or shrimp that are too long for the alimentary canal, and it is common to find a young bird with the tail of a fish sticking out of its mouth.

Though the Least Tern will now and then swoop down to the water surface and pick up a small fish between its mandibles, the normal way is to close the mandibles and spear the fish. Many of the fish discarded in the colony show punctures midway. Some years ago a Caspian Tern (*Hydroprogne caspia*) (Tomkins, 1934) was found with its mandibles stuck in the top of an old piling that was submerged at high tide. The mandibles were closed. Evidently

the tern had plunged at a fish, stuck its mandibles into the piling top and drowned. Plunging in the tern manner is sometimes indulged in by Bonaparte's Gull (*Larus philadelphia*), normally a dabbler, so the method of feeding is not confined to the terns.

FIG. 3. Least Tern 2½–3 weeks old; natal down being replaced by juvenal plumage.

Care of Young.—The things observed within the colony have not been enough different from published accounts for similar species to justify much comment. The young are known individually to the parents even though they wander considerably. When the young are able to fly and follow their parents, each adult, accompanied by one young bird, flies out over the water, plunges and catches a fish, then alights on the water and gives it to the young. Adults are still feeding young when they leave Georgia in September. When the young begin to feed for themselves is unknown. Both the Caspian and Royal Terns, neither of which nests in our immediate locality in any numbers, continue to catch food for the young until about November. These two species and the Least Tern frequently lay three eggs. Why then should one never see an adult followed by more than one young? At this stage the family does not seem to exist as such, but is separated into components of one adult and one young. One might assume that each adult cares for one individual young bird, and for that alone, but is this true? I have no answer at hand.

Even though the young birds, when fully fledged and competent in flight (Fig. 4), do not catch their own food for some time, there seems to be an inherited diving pattern. One day I came by a small borrow pit filled with

water about one foot deep, near a tern colony, and found a young Least Tern repeatedly diving into the pool. The pool had been made recently and had no tidal connection. It had been checked for small fish a couple of times recently. There was no sign that this bird was trying to catch fish, nor did it catch any

FIG. 4. Least Tern in juvenal plumage, able to fly.

while I watched the whole performance. The diving seemed to be play or practice, and at any rate it seemed to satisfy some inherent need in the young bird.

Palmer (1941:92), in his study of the Common Tern, has found such similarity in the feeding of the young when they are able to fly, that it deserves full quotation here: "Soon however, the juvenal begins to follow the parent on fishing trips. When following, it utters a high-pitched *ki-ki-ki-ki* and the adult responds with a *ki* or *kip* or *ke*, this last being a modified first part of the *ke-arr* of alarm. Chick and parent alternate rapidly in this calling. I have not been able to observe the transition from the stage of following the parents to the time when the young fish independently. Probably the Juvenals, which spend some time flying by themselves, sight fish in the water and instinctively dive for it.

"Prior to September 5, 1939, when I left the vicinity of the terneries, I had not seen a single juvenal catch a fish. . . ."

Summary

The Least Tern arrives at the Savannah River Entrance, Georgia, in late April, nests and rears young, and leaves in early September.

Twenty-five to 30 years ago the species was numerous. Its numbers are now reduced to about 5 to 8 per cent of its former numbers, and recent nestings have not been very successful.

The reason may be a reduction of predator-free nesting grounds, but it is not certain.

The courtship and nesting habits are discussed briefly.

Literature Cited

DuMont, P. A.
1934 A revised list of the birds of Iowa. Univ. Iowa Studies. Vol. 15, pt. 5.

Erichsen, W. J.
1921 Notes on the habits of the breeding water birds of Chatham County, Georgia. *Wilson Bull.*, 33:69–82.

Murbarger, N.
1956 The birds of Anaho. *Nat. Hist.*, 65:300–305.

Palmer, R. S.
1941 A behavior study of the Common Tern. *Proc. Boston Soc. Nat. Hist.*, 42 (1).

Pettingill, O. S., Jr.
1937 Behavior of Black Skimmers at Cardwell Island, Virginia. *Auk*, 54:237–244.

Sprunt, A., Jr., and E. B. Chamberlain
1949 South Carolina bird life. Univ. South Carolina Press, Columbia, 585 pp.

Tomkins, I. R.
1934 A curious tern accident. *Wilson Bull.*, 45:128.
1942 Least Tern watering eggs; Gideon Mabbett's query. *Auk*, 59:308.

1231 East 50th Street, Savannah, Georgia, November 14, 1957

EARLY REPRODUCTIVE BEHAVIOR OF FLICKERS

BY LAWRENCE KILHAM

THE purpose of this paper is to record observations on the reproductive behavior of Yellow-shafted Flickers (*Colaptes auratus*) in the early breeding season, both in the field and in an indoor aviary. Some field observations were made at the Archbold Biological Station, Lake Placid, Florida, in February and April, and at Tamworth, New Hampshire, in May of 1958. Year-around observations on flickers have been made in Seneca and Bethesda, Maryland. I have spent approximately 500 hours a year for three years studying the comparative behavior of woodpeckers.

The early breeding season of flickers extends from the time of pair formation to the time of establishment of a nest hole just prior to egg-laying, a period which may last for three months. Bent (1939) and Burns (1900), among others, have described the general natural history of flickers. Descriptions are lacking, however, of tapping, duets of drumming, and even of the various methods of communication in relation to attendant circumstances.

METHODS OF COMMUNICATION

Flickers communicate by dancing, by drumming, by varied vocalizations, and also by tapping, which, as described for Red-bellied Woodpeckers (*Centurus carolinus*), takes place in the early breeding season (Kilham, 1958). Methods of expression may be used with varying intensity and in assorted combinations, depending upon the situations involved. The following forms are distinguishable:

Vocalizations.—

(a) High call.—A loud *kick, kick, kick* of great carrying power, which, at less intensity, sounds like *wick-a-wick-a-wick.*

(b) Dance calls.—The dances of flickers may be accompanied by *we-cup*'s or by soft *chewki*'s, the latter note appearing to be the more intimate one.

(c) Intimate notes.—Notes exchanged by mated flickers are numerous, particularly near the time of coition. Common varieties are *oi-eek, oi-eek,* and *werp, werp* or *what, what,* all of which suggest the low, conversational notes of Blue Jays (*Cyanocitta cristata*).

(d) Alarm call.—*Keogh.*

Dance display.—Flickers dance at full intensity by spreading and uptilting their tails to one side, thus displaying the yellow underside, by raising their red nuchal patches and, concomitantly, swinging and bowing their bodies from side to side as their bills jerk up and down in a W- or a figure-8-shaped course. Many forms of dancing are possible in a range between these extremes, and Noble (1936) has given further description.

Drumming.—The drumming of flickers is like a miniature pneumatic drill, for the individual blows come at a rapid, even rate from start to finish. Each burst lasts for about one second. Pauses between drummings may be anywhere from 10 to 40 seconds or longer, and male and female flickers may drum together, first one, then the other, in an alternating duet.

Tapping.—Flickers tap at a slow, countable rate of two to three taps per second and in bursts of two to 20 or more taps. There is usually a slight pause between bursts. One can learn to recognize tapping at a distance of several hundred yards. I have found no essential difference between the tapping of flickers and that of Red-bellied and Red-headed Woodpeckers (*Melanerpes erythrocephalus*) except that both sexes of the latter two species may tap simultaneously in what I have termed "mutual tapping" (Kilham, 1958 and 1959). Male and female flickers tap at separate times. Tapping for all of these species is associated, predominantly, with selection of a site for a nest hole.

Wing noise.—Flickers may make a *wurrp* noise with their wings when flying, even for a few feet. This noise is one of alarm and is not infrequently associated with the vocalization, *keogh*. Many species of woodpeckers can make ruffle noises with their wings, but the *wurrp* of flickers is unusual in being somewhat musical.

Bill-touching.—My hand-raised flickers occasionally touched or seized each other's bill-tips, often protruding their tongues at the same time. I have not observed bill-touching in the field. Althea Sherman (1910:142) stated that in years of close study of this species she had "never seen anything that suggested the feeding of one mate by the other," and doubted very much if this is done. One wonders, however, whether bill-touching may not represent the courtship feeding of other species. Flickers do not bring visible food, but pump or regurgitate into the open bill of the young one, which seizes the bill of its parent as Sherman has well described. Bill-touching may be symbolic of this manner of feeding. According to Tanner (1942), Ivory-billed Woodpeckers (*Campephilus principalis*) may touch bills in courtship, and Allen (1937:168) wrote that as a female climbed up a pine toward her mate "he bent his head downward and clasped bills with her."

Field Observations

The field observations given below have been selected from many others as contributing to an understanding of the flickers which bred in captivity. These observations fall under three headings:

Pair formation.—The displays and vocalizations of flickers may vary in intensity depending upon whether two of the same sex, or three birds representing both sexes are participating. The following observations were made in mid-winter, in a Florida pasture, before any search for a nest hole was evident.

(a) Dance of males.—A male flicker alit on a pine tree about 8:30 a.m. on February 2. He called *we-cup*, gave an abbreviated high call, then rested a moment before flying to the ground. A second male, equally unhurried, alit in the same grassy opening and the two flickers now faced each other, about four inches apart. About every 15 seconds they would point their bills into the air and wave them about for four or five seconds, exposing their throats and black moustaches in the process (Fig. 1). These odd dances went on in silence for six or seven minutes. The flickers then hopped along to a new opening among the saw-palmettoes (*Serenoa*) for another few minutes of the same performance. They kept wings and tails closed. Both birds finally flew into different trees, and the dances, which may have been between rivals for domination of one section of the pasture, ended without physical conflict.

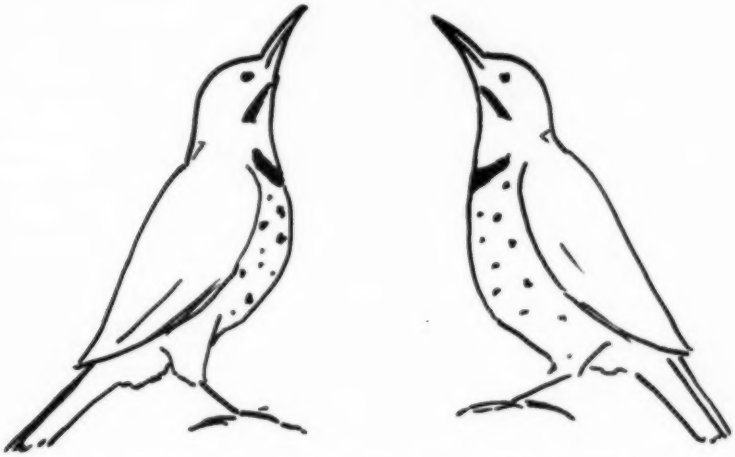

FIG. 1. Silent dance of two male flickers, Florida pasture, February 2, 1958.

(b) Dance of a male and two rival females.—Frost lay on the ground three days later when, at 7:30 a.m., I heard a medley of *we-cup*'s coming from the corner of the pasture where the males had displayed. There were now three flickers, a male and two females. They were all clinging to the trunk of a pine tree and would occasionally join in bursts of bill-waving to the accompaniment of low *we-cup*'s. The male was the least interested. He finally flew to a dead stub where he drummed and gave his high call. The two females quieted down as soon as he had left. Their vocalizations were now *chewki, chewki*, and their bill-waving became rather mild. They soon flew away. The trio reassembled shortly afterward on a dead pine limb where the male was perched on an elbow with the two females flanking him. Dances lasting four or five seconds alternated with periods of quiescence lasting 30 seconds. These dances were at full intensity. All three birds waved their bills, called a shrill *we-cup, we-cup*, raised their red crests and displayed much yellow by partly spreading their wings while fanning and uptilting their tails. The male tried to drum between dances. The females, however, gave him no respite, for they would

start a new dance which, to all appearances, he seemed compelled to join. Affairs continued in this fashion for five minutes. The tempo was gradually decreasing when one of the females suddenly flew at the male, driving him from his perch. This attack aroused excitement all around. The *we-cup*'s were again shrill, and one of the females drummed briefly. A second attack maintained the excitement. This time the aggressive female struck the male as if attempting to alight on his back and the two fell grappling to the ground. The male flicker then flew away. In his absence the two females reverted to a mild bill-waving accompanied by low *chewki*'s and *we-cup*'s. Variations of these performances went on for 1¼ hours.

Search for a nest hole.—

(a) Prolonged communication.—At mid-morning on April 30, a pair of flickers was on the dead pine where the trio had danced on February 5. Their activities over the next hour were as follows: The male was giving full dances. His mate kept bowing her head but was apparently less excited than he was, although both called *we-cup*. She departed on a long flight down the pasture fence. He remained on the dead pine, drumming about once a minute and giving occasional high calls. His mate, in spite of being 250 yards away, joined in with drummings and high calls of her own, as if communicating with him. He made two moves in her direction (Fig. 2) and continued his part of the duet. What looked like an impasse was broken when I chanced to see her returning, first to a pine 60 feet away, then to one adjacent to her mate. He stopped calling. There were no more vocalizations from either bird for 30 minutes, during which time he drummed alone until she broke a 20-minute silence by joining him in the drumming. The duet had no synchronization. Each individual gave a burst about once every 40 seconds. A man piling boards finally frightened the pair away. Events which took place two days later suggested that the long communication of the two flickers had involved possible sites for a nest hole.

(b) Agreement on the female's choice of nest hole.—On May 2 I heard tapping near the tree where the male had drummed in the long communication two days previously. I then spotted the male flicker as he tapped 12 bursts of eight to 12 taps each, just above a shallow, weathered excavation. His mate was on a limb above. When he left, she flew down and inspected the site. She did not tap. At 6:45 a.m., a half-hour later, I found the female calling once more from the pine stub down along the fence from which she had responded in the communication of two days before (Fig. 2). She now entered a hole in the stub, turned around and looked out for five minutes. Then she withdrew and tapped just inside the entrance, where I could see her bill as she gave two bursts of four taps each. The male had reached the entrance by the second burst, his crest raised and tail outspread as he made soft *chewki* notes. She slipped out, brushing past his neck. He now entered and appeared to tap inside. By the intensity with which he excavated the hole, already hollowed in some previous year, and by the coition described below, I presumed that this site had been finally agreed upon. He would appear at the entrance every so often to throw out a bill full of sawdust, sometimes repeating this performance ten or 15 times in succession.

(c) Removal of debris.—The male flicker emerged from the hole in the midst of his excavating with a half-inch piece of debris and, instead of dropping it out of the entrance as flickers may do with larger objects, flew off with it, holding his head high in an awkward fashion. He dropped the debris by an adjacent tree, then wiped his bill. A few minutes later he was again throwing out sawdust when he stopped to carry another piece of debris away from the hole. I had already observed the same phenomenon a number of times with the hand-raised male in the aviary. My conjecture was that, in both cases, a proper-sized object had stimulated the males to perform a piece of parental behavior, for

their awkward manner of flight suggested that of a male flicker leaving the nest with a fecal sack after feeding its young, a form of behavior which I had witnessed.

(d) Coition.—The male had been excavating for an hour when his mate returned, giving a soft *wrr, wrr* note as she alit at the entrance. She showed no interest in excavating on this or later visits. At 9:25 a.m. she had entered and was looking outward when her mate called *we-cup*, and shortly afterward gave a high call from a dead pine 80 feet away. She responded with a low *wick-a-wick*, then flew to him and crouched low on a limb where he mounted her in full coition.

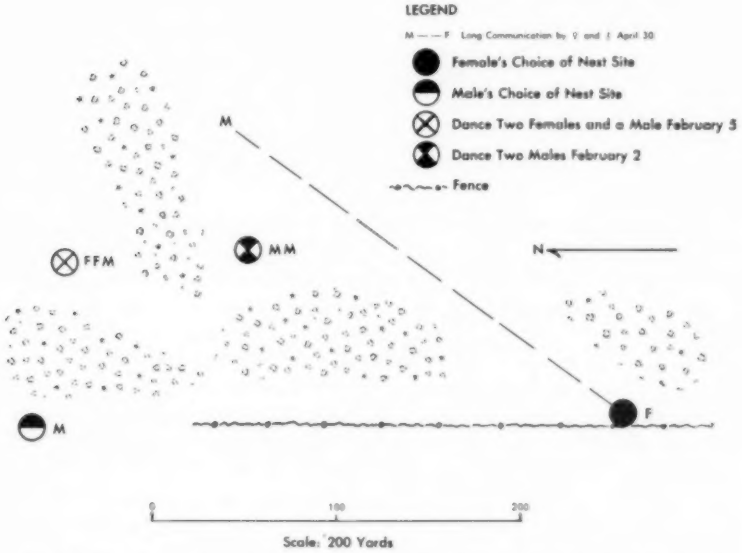

FIG. 2. The Florida pasture. Diagram of the events in the early breeding behavior of a pair of flickers, including conflicts associated with pair formation and a distance communication between the male and female over the site of a nest hole.

Excavation and tapping.—A pair of flickers was excavating a hole just below a limb, 50 feet up in a dead white pine in a woods at Tamworth, New Hampshire, May 18, 1958. I saw the female alight and tap seven or eight times, about six inches above the hole. Her mate flew over, danced on a limb below and gave *chewki* notes. This behavior was different from what I had observed among Red-bellied Woodpeckers, where the male almost invariably initiates the tapping and is frequently joined by his mate (Kilham, 1958). Since dawn is a particularly favorable time to observe the mutual tapping of these woodpeckers, I came on two mornings to see what the flickers might do at this time of day. Events on May 21 were representative. The male had gone to roost in his new excavation on the night of May 20, and he was looking out from the entrance when I approached at dawn. At 5:14 a.m. he emerged to give drummings and high calls from a neighboring dead

pine. He soon returned to rest by his excavation, and I then heard an abbreviated high call as the female approached. The male responded with a full high call. He now moved down to the hole, tapped three bursts of 15, eight, and two taps and then, when his mate alit on a limb above, joined her in a brief dance without vocalizations. I have never witnessed mutual tapping among flickers.

Development of Breeding Behavior in Captivity

Two nestling flickers, about three weeks of age, were removed from their nest hole in Bethesda, Maryland, on July 7, 1957, and kept in an indoor garage, modified into an aviary ten and a half feet square and seven and a half feet high. This pair mated and incubated five fertile eggs the following spring. It was apparent from field observations that the vocalizations and behavior of my hand-raised birds differed in no essential way from those of wild flickers observed in Florida, Maryland, and New Hampshire. One presumes that much of flicker behavior is either innate or is learned prior to leaving the nest.

The two young flickers carried on some phases of breeding behavior in a fragmentary way, but with increasing skill, from the time they were nestlings. Their activities may be outlined as follows:

Juvenile development.—The two fledglings might have left their nest naturally on July 11. On this day the female waved head and body, called *we-cup*, then seized her brother's bill in her own. I witnessed no further bill-touching (Fig. 3A) until December. The flickers were comparatively quiet during July and August but, when approaching each other, they might dance like mechanical puppets and call *we-cup*. They did little drumming in August and the male gave his first high call at the end of the month. A post-juvenal molt was now underway. The female had lost her black moustache by September 9, and both birds had bright yellow under their wings and tails. Their reactions to each other became of increasing interest.

Association and dominance.—The male gave occasional high calls during fall months and usually danced and called *chewki* when coming near the female, whose behavior remained subdued. Both flickers drummed. The bursts might start in a slow way before reaching the pneumatic intensity which became habitual later on. It was evident that the two birds liked to be together, for if he flew to the ground, she might follow and both would toss leaves and soil about with a vigorous prying motion of their bills, within a few inches of each other. His dominance was particularly manifest at feeding places. If he found a good spot, he would give a *we-cup* dance as she approached and she would leave, but if she turned up something of interest, such as an earthworm, he might displace her quietly. This situation continued through the breeding season. There were occasions, however, when the female might display vigorously, and one was when I used a hose to water the earth,

FIG. 3. Some events characterizing the early reproductive behavior of flickers. (A, above) Bill-touching. (B, left) Male at entrance to nest box "swells" upward toward mate who is doing a *chewki* dance on roof. (C, right) Male removing large piece of debris from nest box.

logs and plants in the aviary. The male was much alarmed by this procedure. On September 18 and October 16, he ran about the bottom of the aviary in a furtive manner for some hours, during which time the female assumed a dominant behavior, dancing at full intensity and calling *we-cup*. She appeared stimulated by his submissiveness. This fortuitious experiment suggested that the male's usual activity in dances and vocalizations was a means of maintaining dominance. When he stopped, she assumed the role. The normal male dominance appeared to be important to subsequent breeding, for such problems as which bird should spend the night in the nest hole were solved automatically by the male taking over.

Pair formation.—Wild flickers, observed during the autumn in a swamp near Seneca, Maryland, behaved much like my captive flickers in displaying fragments of breeding behavior. The swamp flickers were migrants. When winter weather led to a cessation of their incipient breeding activities, my captive birds, living indoors, continued to develop. I suspected that something approaching actual pair formation took place in early December. The female became more assertive and this seemed to stimulate the male. On December 10, for example, she was taking much of the initiative, and after a *chewki* dance at full intensity, the two birds seized each other's bills. The female then drummed. She had done little drumming in previous months. The male drummed regularly on an upright ash log, and on January 2 his mate settled two feet below him for an alternating duet. They had many such duets in following months.

Phases of Breeding Behavior

New types of behavior appeared when I placed a nest box in the aviary on March 9. The male kept putting head and shoulders inside to inspect the hole and did the first tapping which we had seen. He continued to tap above the entrance almost daily. The female did not start tapping until March 21, but three days later she gave 50 taps in three consecutive bursts. High calls and dances indicated increasing excitement. I realized by March 25, however, that the nest box was too small, and I replaced it with a larger one. The first egg was laid on May 23. Two cycles were to reach a crescendo, then collapse, before I realized that (1) the box had to be on a pole away from the wall and (2) an aggressive male sapsucker, also paired and trying to breed, had to be removed. Field observations suggested that such phases are not unnatural. Woodpeckers may experience various difficulties and defeats before finding a suitable nest hole, as I have described for one pair of Red-bellied Woodpeckers (Kilham, 1958). There was an interplay of interest between the two flickers. The male would have the greatest interest at the start of a cycle and periods of intense excitement might follow as he roused his mate to an

enthusiasm for the potential nest hole. Her interest would finally collapse in abortive cycles, to his obvious distress. I would then re-locate the nest box. The flickers went on to repeated coition and egg-laying when my last efforts produced a suitable arrangement. The activities involved in a typical cycle may be outlined as follows:

Efforts of male to win female to nest box.—

(a) Entry to box.—The male went completely inside the new nest box from the day it was installed, but the female, for some days, did no more than cling to the entrance and look in. Either bird might hang from the entrance by one foot to sound the outside of the cavity with a few pecks or explore it with its long tongue.

(b) Tapping.—While both sexes tapped above the entrance on the first day, the male did most of the early tapping and was the first to tap from the inside. On April 14, for example, he tapped three bursts of 14, 20, and three taps, respectively, on the outside. He later tapped ten bursts on the inside. One could see his head moving just within the entrance and I counted 33 taps in one of the bursts.

(c) Response of female to tapping of male.—The more common responses of the female to the tapping of her mate were (1) to drum or (2) to give a high call. (3) She sometimes answered with soft notes such as *what, what* and (4) she might fly to the roof for a *chewki* dance while the male was below at the entrance (Fig. 3B). (5) Finally, the female might fly to the entrance when he had tapped from the inside and the two would face each other, he sinking low while her head was high.

(d) Female follows male.—She would follow male persistently, soon joining him wherever he might alight, and often initiating dancing.

(e) Other activities.—Duets of drumming, occasional bill-touching and shrill *we-cup*'s continued in a random fashion. The loud, persistent high calls of male flickers are one of their best-known activities in nature. My captive birds gave relatively few high calls. By one interpretation, the caged birds were already paired and the male had, in consequence, no need to call up a mate.

Rising acquiescence of female.—Two weeks after I had installed a new nest box activities became very intense. The female started performing much of what her mate had been doing and he started new forms of behavior.

(a) Male and female in box together.—The female now began to enter the box for the first time and soon both flickers went into the nest together. She usually came out first. If she happened to be inside and he looked in, she might squeeze out past his neck.

(b) Male removes sawdust from box.—When the female started taking a greater interest, her mate began removing some of the sawdust which I had placed in the bottom of the box. Instead of tossing it out of the entrance as excavating flickers usually do (*vide supra*) he might carry up to five billfuls across the aviary and deposit them (Fig. 3C). His manner of holding his head high was suggestive of a parent flicker flying off with a fecal sack. Since the nest box was fully excavated to begin with, sawdust removal appeared to be a ceremony or rehearsal of events to come.

(c) Tapping.—The female began to tap more on the outside of the box, and the male to tap at the bottom of it, so that we could no longer see his head moving.

(d) Male seizes female.—When the two flickers were in the box together, the male might seize his mate as she started to wriggle out. One could see small feathers clinging to his bill afterward and I noticed an increasing number of them about the aviary.

(e) Swelling upward at entrance.—If the male tapped while at the outside of the hole, the female might alight on the roof and bend downward in a *chewki* dance. The male

would raise his red nuchal patch, then swell upward toward her without moving his feet from the lower rim of the hole. At a later time, when she had begun tapping more frequently, she would swell upward toward him in similar fashion or, if he only came near the box, she might swell sideways with her breast toward him.

(f) Female swoops on male.—When the male was at the entrance or was feeding on the ground, his mate might swoop down in flight as if to peck him.

(g) Soft notes by female.—The female made an increasing number of soft notes, such as, *what, what* and *oi-eek, oieek* as the activities of the pair were becoming increasingly quiet.

(h) Male seeks coition.—The male would come along beside the female in a manner not observed previously. He behaved as if trying to mount, but she would move away.

(i) Other activities.—There was occasional bill-touching and a decline of drumming in the late part of the cycle.

Collapse of female interest.—The female lost interest toward the end of each of the first three cycles of breeding behavior which took place between March 9 and May 4. The male reversed roles and pursued her when she no longer came to the box. A fourth and successful cycle began on May 4.

Full acceptance of nest hole by female.—As indicated by the behavior described below, the female quickly accepted the nest box when I hung it on a pole and removed the male sapsucker from the aviary.

(a) Extensive tapping by female.—On May 5, in the final cycle, the female tapped ten bursts of six to eight taps each when she was inside the nest box. Her head was just showing. She later tapped out of sight at the bottom of the box in the manner of her mate's earlier behavior.

(b) Female by box more than male.—She spent increasing amounts of time clinging to the entrance hole or quietly disappearing inside. Her mate might look in briefly, then leave.

(c) Female invites coition.—The pair was often on the ground feeding when she would fly up making soft *oik*'s to crouch on a limb by the window. He would follow immediately. Full coition took place on some occasions and pseudo-coition at others. In full coition, the male would fly to the female when she had assumed the inviting pose, mount her back, then take time to get well established. He would peck down at her bill, meanwhile falling off to her left side and somewhat backward as cloacal contact took place. We might observe coitions three or four times a day, but they were undoubtedly more frequent. They might take place at any hour. The final breeding phase began on May 4, coition was first observed on May 7, the first egg was laid on May 23, and full coition was last observed on May 27. A fifth egg was laid on May 29.

(d) Female attacks male.—The aggressiveness of the female came as a marked change from her earlier subdued manner. When she was in the box, she might draw back and strike at her mate when he came to the entrance. She also did this at a later time when brooding eggs.

(e) Increasing quiet.—There were few noises compared with previous weeks. Drummings and high calls were infrequent, but the pair did exchange soft, low notes.

Laying and incubation of eggs.—It was evident when the female had laid her first egg, for she filled the whole entrance by puffing out her breast feathers and drawing her head back as if ready to strike. She struck at my hand savagely when in the same pose four days later. This was unusual boldness, for she had always been shy.

(a) Eating of eggshell.—When a hen's eggshell was placed in the aviary on May 27,

the male immediately explored the fragments with his tongue and left. His mate then flew down and devoured the pieces eagerly.

(b) Nest relief and tapping.—The female came to the entrance, making soft notes, at 7 a.m. on May 27. Her mate tapped briefly from the bottom of the nest, then slipped out of the entrance. She entered thereafter. A similar episode took place on the following day, only he remained where he was.

(c) Male spends night in nest hole.—The male did not spend any nights within holes from the time I first got him in July until May 29 of the next year when the last egg had been laid. He then spent every night in the hole until June 5.

Final collapse.—I finally decided not to attempt any full nesting of the flickers, since we were about to go on leave, and early breeding behavior had been the principle object of the study. The female flicker lost all interest in incubation when I re-introduced the male sapsucker. Her mate persisted longer but was much disturbed at not being relieved at the nest, and the two dramatic events which took place possibly resulted from his frustration.

(a) Savage attack by male.—The female was attacked by the sapsucker early on the morning of May 30 and was too frightened to come to the nest. Her mate waited for her a long time. He finally came out and began a relentless attack, driving her back and forth across the aviary to the point of exhaustion. He then alit on her body and pecked at her head. She only escaped by crawling into a hollow log from which I pulled her some hours later. I removed the sapsucker to give her a respite, and she recovered sufficiently to resume incubation late in the afternoon.

(b) Male destroys eggs.—Both flickers had lost interest by June 5 and were feeding together in the afternoon. After a half hour of quiet activities, the male suddenly went wild. Apparently there was no immediate cause for this explosive behavior consisting of a mixture of high calls, drummings and *we-cup* dances before his mate, interspersed with frantic flying to and fro. She followed him about but remained calm. The male now went to the nest and emerged with an egg which he deposited on the ground. He then carried out three more eggs, all of which oozed blood from punctures and contained embryos. The fifth egg was punctured but not removed. After this episode the pair became as peaceful as before.

Displays Against Territorial Rivals

On February 22, 1959, I put the pair of hand-raised flickers into a large cage on the outside of the house. Within a few hours a pair of wild flickers was displaying on the outside of the wire. The yard resounded with high calls and drummings. Both wild birds would fly to the wire with outspread wings and tails displaying the full yellow as male postured opposite male and female against female. This sex alignment was an invariable pattern. The displays continued vigorously throughout the next day in spite of rain and with some lessening of activity for the next three weeks until I returned the captive birds to the aviary. The wild female flicker (WF) was the most persistent. She would run around the edge of the wire, tilting way over in constant *we-cup* and *chewki* dances, following the tame female (TF) wherever the latter moved. TF responded with similar dances. WF sometimes drummed loudly on a tin gutter above the cage or gave high calls from adjacent trees. The wild male

carried on in the same manner as his mate. He was less interested, however, and would fly away after a shorter time. The tame male did not pay much attention to him.

This experiment with an outdoor cage had interest from three points of view: (1) the wild flickers were apparently paired and ready to defend a territory in late winter; (2) in territorial conflicts male displayed against male and female against female; and (3) the displays, vocalizations and drummings used in these conflicts were much the same as those observed during courtship.

Discussion

The Green Woodpecker (*Picus viridis*) resembles the flicker in feeding on the ground and in having a long protrusible tongue. Blume (1955) made observations on a pair of these birds in May. The male and female communicated with each other over a distance of 500 meters in a "*Rufkorrespondenz*" which continued for a long time, the female calling from the vicinity of the subsequent nest tree. Blume believed that she chose the final site. Thus in the long communication which Blume described for May 1, as in the one which I observed in Florida on April 30, the female was trying to attract the male from his preference for a nest site to hers, or so it appeared, for in each case the female's choice was the one finally accepted.

Woodpecker behavior is open to varied interpretation. Noble (1936:279), after observing and experimenting with a pair of flickers over a few weeks in the breeding season, concluded that the dance of the flickers was "in no sense a method of attracting or stimulating individuals of the opposite sex, but rather a means of defending territory and driving off rivals." This statement represents a limited interpretation. My captive flickers, for example, danced the year around in a complete absence of specific rivals. I have concluded from field and aviary studies that the dance displays, like many of the vocalizations, drummings and tappings made by flickers, are usually made to attract or stimulate individuals of the opposite sex. Flickers, like other woodpeckers, are most expressive in the early breeding season. More studies will be needed before one can fully interpret their behavior.

Summary

1. The early breeding behavior of flickers has been studied in the field and in an aviary where a hand-raised pair mated and laid fertile eggs.

2. Methods of communication include drumming, tapping, dance displays, wing noise, bill-touching and vocalizations. The last method is categorized into high calls, dance calls, intimate notes and alarm call.

3. Field observations:

(a) Pair formation appeared to take place in mid-winter without reference to a potential nest hole.

(b) A conflict of males at this time was limited to movements of heads and bills, without vocalizations or physical contact.

(c) The most intense displays and vocalizations arose when two females competed for a male. One female attacked the male several times.

(d) In the course of a search for a nest hole in April, a pair of flickers communicated with each other by dances and *we-cup*'s, then by a long distance communication of drums and high calls, and finally, on rejoining, by a duet of drumming. The female's choice of a nest hole was the one accepted by the pair.

(e) Male and female flickers tap in the same manner but not at the same time; the tapping is done in relation to potential nest holes or to ones being excavated.

4. A pair of captive flickers experienced four phases of breeding in which the female evidenced increasing acceptance of the nest box as the male took the lead in arousing her interest. After three failures in which the female's interest collapsed, the box was finally located in a favorable situation and successful mating took place. The interplay of behavior between the two sexes went through the following stages:

(a) Breeding behavior was precipitated when a nest box was placed in the aviary on March 9.

(b) The male was always the first to enter the box in each location, to tap on the outside by the entrance and, later, on the inside. His mate would carry through the same performances after a delay of some days.

(c) The pair danced together, had duets of drumming and occasionally touched bills at this early stage.

(d) As the female began to accept the nest she spent more time clinging to the entrance, made intimate notes and sometimes entered the nest box with the male.

(e) With this increase of interest by the female, the male began to tap out of sight at the bottom of the nest hole and to remove sawdust.

(f) The excavating male might occasionally carry a piece of debris well away from the nest box, then wipe his bill. This behavior followed the pattern of a parent male flying from the nest with a fecal sack.

(g) With continued increase of the female's interest, the male sought coition, but she was unresponsive, initially.

(h) Once the female had accepted the nest box, she invited coition by crouching low on a limb, many times a day. Full coition would follow if the male was ready. Otherwise he might mount and come off in pseudo-coition.

(i) Vocalizations and displays were minimal at this late stage. The female did a good deal of tapping at the bottom of the nest box and she might strike at the male when he came to the entrance.

(j) As soon as the female had laid her first egg, she began to rest in the entrance with her breast feathers puffed out, ready to strike at any intruder.

(k) The male began spending nights in the nest box after the fifth and last egg was laid.

5. Dances and vocalizations associated with territoriality were demonstrated when a pair of wild flickers displayed against the hand-raised pair, which was kept in an outside cage for three weeks.

Literature Cited

Allen, A. A. and P. P. Kellogg
1937 Recent observations on the Ivory-billed Woodpecker. *Auk*, 54:164–184.

Bent, A. C.
1939 Life histories of North American woodpeckers. *U. S. Nat. Mus. Bull.*, 174:334 pp.

Blume, D.
1955 Uber einige Verhaltensweisen des Grunspechtes in der fortpflanzungszeit. *Vogelwelt*, 76:193–210.

Burns, F. L.
1900 A monograph of the flicker. *Wilson Bull.*, 7:1–82.

Kilham, L.
1958 Pair formation, mutual tapping and nest hole selection of Red-bellied Woodpeckers. *Auk*, 75:318–329.
1959 Mutual tapping of Red-headed Woodpeckers. *Auk*, 76:235–236.

Noble, G. K.
1936 Courtship and sexual selection of the flicker (*Colaptes auratus luteus*). *Auk*, 53:269–282.

Sherman, A. R.
1910 At the sign of the Northern Flicker. *Wilson Bull.*, 17:135–166.

Tanner, J. T.
1942 The Ivory-billed Woodpecker. Res. Rep. No. 1, Nat'l Aud. Soc. N. Y. 111 pp.

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TESTICULAR RESPONSE IN BOBWHITES TO INTERRUPTED DARK PERIODS[1]

BY CHARLES M. KIRKPATRICK

In many photoperiod studies relating to reproduction in birds, the basic technique is the use of light to influence gonadal development and function. In Bobwhites (*Colinus virginianus*), gonadal responses to light are unequal between sexes. Incidental evidence from previous experiments (Kirkpatrick, 1955) indicated that cocks become sexually mature substantially before hens lay, when both have received identical light treatment and management. In quantitative photoperiodicity studies based upon time, intensity, or other variables, it is never implicit that results pertaining to one sex of Bobwhites apply to the other sex. Thus, experiments to test the effects of light upon reproductive response in Bobwhites, and perhaps other species, should be designed accordingly if the desired end point is a mere stimulation of tissues, full spermatogenesis, or ovulation. This paper reports an experiment to determine the time required for Bobwhite cocks to produce mature sperm under certain conditions of lighting, and compares the thresholds of sperm production and egg laying.

Methods

The procedure of the present experiment was to sacrifice cocks after regular intervals of exposure to interrupted dark periods (Kirkpatrick and Leopold, 1952) for an evaluation of testicular development stages. It was not proposed to analyze or describe the minute details of testis histology at the sacrifice intervals, but merely to correlate the intervals with the more obvious aspects of testicular development, namely, weight, tubule expansion, lumina formation, and free spermatozoa. The accepted sign of sexual maturity in the males was the shedding of free sperm into the lumina of seminiferous tubules seen in prepared testis sections. Spermatozoa in fowls require a ripening period of about 24 hours in the excurrent ducts before they are capable of fertilization (Munro, 1938); but in this study, any requirement for sperm to collect or mature in the vasa deferentia or ejaculatory ducts as an essential step in maturation was not considered.

The laying performance of hens held as cage mates of the sacrificed cocks was recorded. This permitted a comparison between the two sexes with respect to the amount of time needed for development of full sexual activity under experimental conditions.

The experiment was begun indoors in January, 1958, with 19 cock and 12 hen Bobwhites 19 weeks old which had been reared on wire and fed a standard poultry growing mash while exposed to nine hours of light per day. One week

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before experimental lighting started, 12 pairs were formed and held one pair to a cage, seven males were caged individually, and all were fed a standard poultry breeding mash. One week later, lighting was conformed with an interrupted dark-period schedule (Kirkpatrick, 1955) in which 10 hours of light were given in two increments, one of nine hours and another of one hour, the latter splitting a 14-hour dark period. Incandescent light intensity at bird level was 30–35 foot-candles and the environmental temperature averaged 60°F., with fluctuations not exceeding about eight degrees. The details of physical arrangements for cages, lighting, and daily management have been described before (Kirkpatrick, 1955).

Samples of lighted cocks were sacrificed at regular intervals. On the beginning day of the experiment, three cocks were sacrificed to establish the weight of unstimulated testes for comparison with testis weights of lighted cocks sacrificed at weekly intervals thereafter.

The number of cocks examined at each interval was chosen to make the best use of the total number available, which was somewhat less than optimum. Previous experience indicated that the longer treatments would result in more unequivocal effects, thus fewer birds were needed for the 5-week sample, since all on that interval were expected to reach full spermatogenesis. Conversely, shorter treatments, up to four weeks at most, were expected to result in unequal development ranging from threshold stimulation of the testis to full spermatogenesis. Consequently, as many birds were examined the first two weeks as during the last three weeks.

The combined weights of testis pairs were determined while fresh on a Roller-Smith torsion balance, and the larger testis of each pair was fixed in an alcohol-formalin-acetic acid mixture. Testis sections were cut and mounted with standard procedures followed by a triple stain. Microscopic inspection of sections provided information on tubule development and spermatogenesis. The average tubule diameter for each group was determined by measuring in each testis the smaller outside diameters of 10 of the most nearly circular seminiferous tubules.

Results and Discussion

A summary of previous experiments is pertinent to the present results which are given in following paragraphs. Kirkpatrick (1955, and unpub. data) found that cock Bobwhites form mature sperm before hens lay eggs, when both receive similar treatment. First eggs from unsacrificed pairs were fertile, indicating transfer of sperm before egg-laying. One pair of Bobwhites produced fertile eggs 14 days after it was placed under incandescent light of 300 foot-candles for 17 hours per 24-hour cycle. Lower intensities (0.1–100 foot-candles) induced fertile eggs on an average of 32 days of lighting in 19 pairs.

In experiments of this nature, egg fertility established the onset of cock potency as occurring roughly no later than ovulation of the particular egg. When the interrupted dark-period method was used, and intensity varied, cocks on one foot-candle had motile sperm after 37 days. Their mates failed to lay during the same period, but hens that were on 10 foot-candles did lay.

The question of how much time is required for cock Bobwhites to produce free sperm under known conditions of artificial lighting is answered by the present results within limits set by the sampling interval. A sampling of cocks at weekly intervals was intended to discover the threshold appearance of free sperm in testis tubules seen in prepared testis sections. The threshold in days for the release of sperm was 7 to 14 days for the most precocious male and 14 to 21 days for the remaining males. The essential information leading to this conclusion is given in the following testis descriptions for the weekly intervals, in Table 1, and in Figs. 1–4.

TABLE 1

TESTIS RESPONSE OF BOBWHITES SUBJECTED TO INTERRUPTED DARK-PERIOD LIGHTING

Treatment, numbers and response	Sacrifice interval (weeks)					
	0	1	2	3	4	5
Total interruptions (hours)	0	7	14	21	28	35
Number in sample	3	4	4	3	3	2
Average testis weight						
Grams	.06	.09	.39	.80	1.30	1.16
Per cent of body weight	.04	.05	.22	.42	.72	.64
Microscopic observations						
Testes with lumina	0	0	4	3	3	2
Testes with free sperm	0	0	1	3	3	2
Ave. tubule diameter (micra)	75	84	158	188	196	194

Testis at 0 Weeks.—After a week of conditioning on nine hours daily of artificial light (at 0 weeks with respect to the stimulating light treatment), the gonads of three cocks were in the typical inactive condition (Fig. 1). Most tubules had two irregular rows of spermatogonia situated near the basement membrane. No lumina were present. Tubules were filled with a matrix in which numerous, scattered large cells with prominent nuclei were in various stages of development or degeneration. The interstitial cells packed within the intertubular spaces had circular nuclei and little cytoplasm. The large intratubular cells appeared similar to those described for passerines (Blanchard, 1941; Wolfson, 1942) and for gulls (Johnston, 1956). In more closely related young pheasants examined in late winter, primary spermatocytes were the most advanced elements, although occasional small lumina were seen (Kirk-

patrick and Andrews, 1944; Hiatt and Fisher, 1947). Since large cells have been observed in inactive testes in several species, and variously referred to as second-order spermatogonia or inactive spermatocytes (Johnston, 1956), I interpret the immature testis of the Bobwhite as conforming to the general picture seen in other birds.

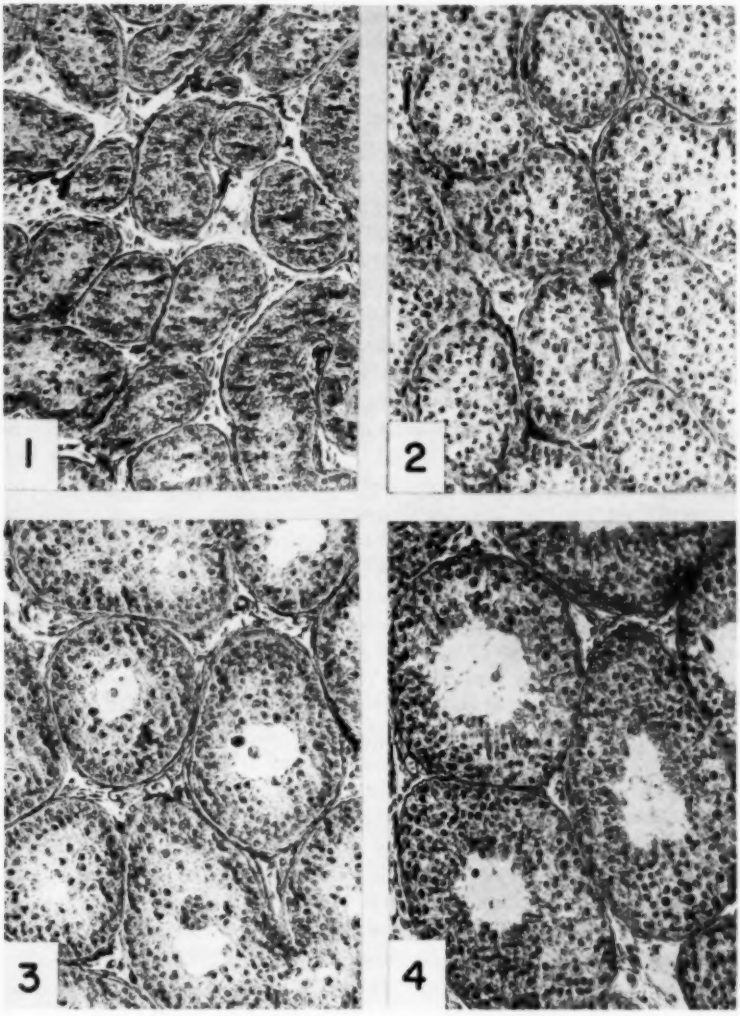
At this stage the average testis weight of 64 mgs. was lowest of the six weekly observations, and corresponded to values of 63 mgs. and 81 mgs. for unstimulated cocks held indoors under "short-day" light (Kirkpatrick, 1955). Average testis weight of unstimulated cocks of comparable age and size held outdoors was 18 mgs. in January, and 34 mgs. in March (Kirkpatrick, unpub. data). The higher values for indoor birds suggest that uniform and higher temperature may cause some increase in testis size.

Testis at 1 Week.—After seven daily 1-hour dark-period interruptions, testis weight and tubule size had increased markedly. No lumina had appeared. Some large cells were still present in the tubule matrix but primary spermatocytes predominated, many in synaptic stages. In some areas the interstitial cells were organized with quantities of cytoplasm not seen the week before (Fig. 2).

Testis at 2 Weeks.—In four individuals, new testis developments ranged from a few lumina and secondary spermatocytes to free sperm in lumina. In the most precocious bird, sperm had collected in the vasa deferentia. The average testis weight for this group exceeded a four-fold increase and average tubule diameter doubled that for the 1-week group. The absolute testis weights ranged 0.26–0.46 grams, with the more advanced spermatogenesis found in the heavier testes. Interstitial tissue was apparently reduced as a whole, but this might have been a mere flattening and redistribution among enlarging tubules as suggested by Rowan (1929) for juncos.

In one bird (Fig. 3), lumina were just opening in some tubules. In another, development had proceeded a bit farther with correspondingly more lumina and a few secondary spermatocytes which were absent in the former. In the third bird, most tubules had sperm bundles attached to the peripheries of wide lumina, but free sperm were absent. The remaining bird had free sperm in most tubules, and sperm had accumulated in the vasa deferentia.

Testis at 3 Weeks.—Testis weights doubled those of the previous sample and tubules were markedly larger. A uniform level of spermatogenic development prevailed throughout the group. All birds had free sperm in some tubules with lumina of most remaining tubules lined with sperm bundles and spermatids (Fig. 4). Some tubules in one testis were clogged with cellular debris. This phenomenon indicated arrested development of single tubules rather than regression of the whole testis, since spermatogenesis was proceeding actively in some tubules and the organ was not of maximum size.



FIGS. 1–4. Cross Sections of Bobwhite Testes, all ×175. FIG. 1. Bird sacrificed at start of experiment after lifetime treatment of nine hours light–15 hours dark. FIG. 2. Bird sacrificed after one week of interrupted dark-period treatment. FIG. 3. Bird sacrificed after two weeks of interrupted dark-period treatment. FIG. 4. Bird sacrificed after three weeks of interrupted dark-period treatment.

Testis at 4 and 5 Weeks.—At the end of four weeks all cocks were sexually functional and maximum testis weights for this experiment were reached. A slight decrease in testis measurements at the final interval is the result of natural variation, as one bird at the 5-week interval, although fully developed, had a lower tissue weight and ratio than any of the 4-week birds. Both groups may be considered as one since all birds were shedding sperm and their testis measurements, uniformly greater than those for the preceding groups, were essentially similar. In terms of function, one precocious male attained full development at two weeks with testis tissue weighing 0.46 grams, and all males were mature in the 3-week group with average testis expansion to 0.8 grams. In previous experiments, I found that Bobwhite testes of 0.3 grams or more usually contain free sperm, and that continued light stimulation caused additional growth to a maximum of 2.1 grams or 1.2 per cent of body weight. The average testis size for 14 cocks after receiving 17 hours daily light (intensities not uniform for all) for 44 days was 1.46 grams (Kirkpatrick, 1955, and unpub. data). When the average testis weight for the 4- and 5-week groups are combined, the resulting value of 1.2 grams shows that testis growth had approached the maximum size recorded for larger samples subjected to more hours of light.

Production of Sperm vs. Eggs.—The laying records of hens kept with the males used in this experiment afforded a comparison with sperm production to determine differential timing of sexual maturity. The comparison is rough because the events compared are not analogous. Free sperm as seen in testis tubules are not analogous to laid eggs, but rather to ovulated ova. Ovulation antedates oviposition by some hours. The time between ovulation and laying, unknown for quail hens, is about 25 hours in the domestic fowl (Warren and Scott, 1935). In this experiment the smallest difference in production thresholds for sperm and eggs was 26 days, more or less. The largest difference was 47 days. Hence, a delay of one or even two days by the quail ovum in the oviduct does not alter the difference significantly.

The first egg was laid 61 days after lighting started. Four hens laid their first eggs on an average of 66 days. Nine hens under observation laid their first eggs in 61 to 109 days (average 80 days). The sperm records made by dissection were in contrast to the egg records. Sperm were found in testes and in vasa deferentia at 2-, 3-, 4-, and 5-week intervals. All males examined after three weeks of lighting had sperm. Therefore, cocks shed sperm in one-half to one-quarter of the time required for hens to lay eggs.

In other experiments differing from the present one with respect to duration, age of birds, and various environmental conditions, first eggs produced were fertile (Kirkpatrick, 1955, and unpub. data). Although the cocks were not examined periodically to establish the earliest presence of sperm, the avail-

able evidence supports the conclusion that, when cock and hen Bobwhites are subjected to similar experimental conditions, the average cock precedes the average hen in sexual maturation.

Summary

When immature Bobwhites were subjected to interrupted dark-period lighting, testis weights and tubule diameters increased, but no lumina had formed after one week of lighting. Testis sections showed that one cock had free sperm in its testes and vasa deferentia after two weeks, and all cocks examined at three, four, and five weeks had responded similarly. The threshold for free sperm production was between 7 and 14 days as contrasted with the first egg at 61 days by a hen on the same treatment. When lighted Bobwhites have produced fertile eggs in much shorter periods, the experiments were not designed for determination of the time differential in sperm and egg production.

Literature Cited

Blanchard, B. D.
1941 The White-crowned Sparrows (*Zonotrichia leucophrys*) of the Pacific seaboard: environment an annual cycle. *Univ. Calif. Publ. Zool.*, 46:1–178.

Hiatt, R. W. and H. I. Fisher
1947 The reproductive cycle of Ring-necked Pheasants in Montana. *Auk*, 64: 528–548.

Johnston, D. W.
1956 The annual reproductive cycle of the California Gull. I. Criteria of age and the testis cycle. *Condor*, 58:134–162.

Kirkpatrick, C. M.
1955 Factors in photoperiodism of Bobwhite Quail. *Physiol. Zool.*, 28:255–264.

Kirkpatrick, C. M. and F. N. Andrews
1944 Development of the testis in the Ring-necked Pheasant. *Anat. Rec.*, 89: 317–323.

Kirkpatrick, C. M. and A. C. Leopold
1952 The role of darkness in sexual activity of the quail. *Science*, 116:280–281.

Munro, S. S.
1938 Functional changes in fowl sperm during their passage through the excurrent ducts of the male. *J. Exp. Zool.*, 79:71–92.

Rowan, W.
1929 Experiments in bird migration. I. Manipulation of the reproductive cycle: Seasonal histological changes in the gonads. *Proc. Boston Soc. Nat. Hist.*, 39:151–208.

Warren, D. C. and H. M. Scott
1935 The time factor in egg production. *Poul. Sci.*, 14:195–207.

Wolfson, A.
1942 Regulation of spring migration in juncos. *Condor*, 44:237–263.

Department of Forestry and Conservation, Purdue University, Lafayette, Indiana, June 24, 1959

SUBSPECIES OF THE CANADA GOOSE IN MICHIGAN

BY ARTHUR E. STAEBLER

THE natural occurrence of various subspecies of the Canada Goose (*Branta canadensis*) in Michigan, especially during the breeding season, has been confused during recent decades by strays from domestic flocks and by restocking activities. We can assume, however, that Canada Geese either collected or live-trapped during migration or winter visitant periods are genuine wild birds. This study was made to determine the subspecies of *B. canadensis* which may occur in Michigan during the nonbreeding seasons.

As Delacour (1954:145, 151) has pointed out, our knowledge of Canada Geese is still too scanty to make a satisfactory taxonomic arrangement of the subspecies of this group. There are differences among the various subspecies of *Branta* which are evident only in the living birds. Unfortunately, these differences, such as relative body proportions, voice, actions, and over-all carriage, are generally lost in the study skin. Hanson and Smith (1950:203–204) describe the interesting observations of Indians living in the James Bay region, Ontario, Canada, who recognize four different kinds of Canada Geese on the basis of field characteristics. Mayr (1942:242) points out the role of field characteristics, such as pair formation, family ties, and colonial nesting, in furthering the complex species development in *Branta*.

During a five-year period from 1949 through 1953, I conducted a banding program of Canada Geese at Michigan State University's W. K. Kellogg Bird Sanctuary in Kalamazoo County, Michigan. The Kellogg Sanctuary has been a favorite resting place for fall migrating geese since the early 1930's. The numbers of Canada Geese on the Sanctuary were counted periodically during the fall migration period; the numbers recorded for each year during the course of the study are shown in Fig. 1. There was no way of determining the total numbers of geese that visited the Sanctuary during a given fall. In some years, 1949 in particular, the flocks of geese remained in the area for a prolonged period of time, thus producing a large build-up in numbers as the season progressed. In other years, as in 1950 and 1951, the birds appeared to remain only a day or so in the Sanctuary area before continuing their migration.

A total of 1,115 Canada Geese were examined at the Sanctuary by me during the five-year period; 931 were banded, 60 of these were recaptured in later years, and 64 dead geese were picked up on the Sanctuary grounds for examination. Sex, age, plumage characteristics, weight, and certain morphometrical data (length of wing, tail, culmen) were recorded for each specimen. During the course of the field work certain specimens were saved as study skins, and these were deposited in the collections of the Museum of Zoology, University

of Michigan. Only those subspecies for which there is a specimen collected in Michigan are included in this report, and all specimens referred to here are in the U.M.M.Z.

I am indebted to the late Josselyn Van Tyne, who made the collections and other facilities of the U.M.M.Z. available to me. I also express my gratitude to Jean Delacour for his examination and identification of several specimens, and to Austin Rand for allowing me to examine the specimens of *B. canadensis* in the Chicago Museum of Natural History.

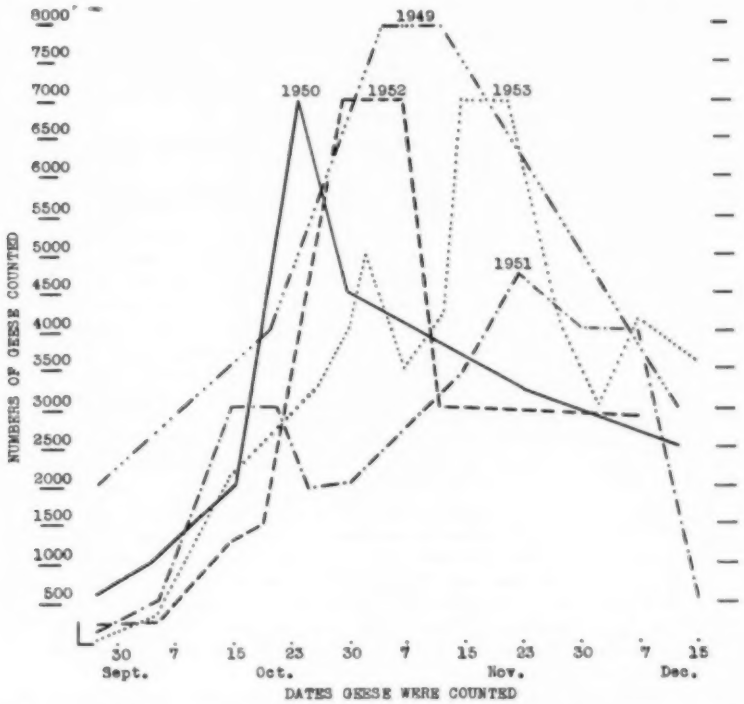


FIG. 1. Numbers of Canada Geese counted on the W. K. Kellogg Bird Sanctuary during the fall migration periods in 1949–1953.

SUBSPECIES ACCOUNTS

Branta canadensis interior.—Four specimens, two identified by Delacour, collected between late October and early December in Kalamazoo County are referable to this form, as are two other specimens taken in early April in Van Buren County. Other specimens of *interior* taken in Michigan include one each from Washtenaw (April), Ingham (November), and Sanilac (December) counties and one from the St. Clair River area (May).

B. c. interior is believed to be the most abundant Canada Goose in Michigan, both as a migrant and as a winter visitant. With the exceptions mentioned beyond, all of the birds handled at the Sanctuary are believed to have been of this race.

Branta canadensis moffitti.—Four specimens of *moffitti*, two of them identified by Delacour, are in the U.M.M.Z. All are from the Kellogg Sanctuary area; three were taken in December, and one in April. Of interest here is one specimen of this race taken in early November on the Ontario, Canada, shores of Lake St. Clair. Although *interior* appeared to be at least 20 times more abundant in the Sanctuary area than *moffitti*, nevertheless, the latter form is regarded as a regular migrant and winter resident in Michigan.

Branta canadensis parvipes.—Two specimens of *parvipes*, both identified by Delacour, have been taken at the Kellogg Sanctuary (October and November). An examination of my original data of geese examined during banding operations indicates that possibly as many as 20 specimens of *parvipes* were banded and released there during the five-year period. *B. c. parvipes* may be regarded as a rare but regular fall migrant in southwestern Michigan; its status elsewhere in the state is unknown.

Branta canadensis taverneri.—*B. c. taverneri* is not recognized in the latest edition of the A.O.U. Check-list (1957). Delacour (1954:168) describes the relationship between *taverneri* and *minima* during the breeding season as very similar to that which exists between *parvipes* and *hutchinsii*. The two smaller forms, *minima* and *hutchinsii*, nest on the coastal tundra while the somewhat larger ones, *taverneri* and *parvipes*, nest inland.

There is a series of specimens of Canada Geese in the U.M.M.Z., collected inland from Point Barrow, Alaska, during the breeding season (late May and early June). These specimens were formerly part of the Max M. Peet Collection and are the specimens of that collection referred to by Bailey (1948:151-155) as *B. c. leucopareia*. On the basis of Delacour's (1954:167) description, I believe these specimens are good examples of *taverneri*. A small Canada Goose was taken by a hunter at the Swan Creek Refuge, Allegan County, Michigan, on October 22, 1954; the specimen, now in the U.M.M.Z., is an adult male and compares very well with the specimens of *taverneri* on hand.

Branta canadensis hutchinsii.—A single specimen of this small goose was taken in Baraga County, Michigan, on October 22, 1949; it is an immature female. Earlier references to *hutchinsii* in Michigan (Sutton, 1927:559; Wood, 1951:44) are subject to question, because the specimens referred to are no longer available for examination, and they may have been any one of the three smaller races of *B. canadensis* now known to occur in Michigan.

During the last two weeks of October, 1949, three small Canada Geese were observed on several occasions on the Sanctuary. Studied with the aid of a 20× spotting scope, the short, stubby bill which is characteristic of *hutchinsii* was evident, and the birds appeared to be little larger than male Mallards (*Anas platyrhynchos*). These small geese were probably *hutchinsii*, but because critical examination in the hand could not be made, their identity remains uncertain.

Branta canadensis canadensis.—No specimens of *B. c. canadensis* in the U.M.M.Z. were taken in Michigan. Presumably, this subspecies may occur within the state, for a specimen of *B. c. canadensis* was taken in November on the Canadian side of Lake St. Clair. None of the specimens handled during the banding operations at the Sanctuary appeared to me to be an example of this race.

Literature Cited

A.O.U. Check-list Committee
1957 Check-list of North American birds (5th ed.). American Ornithologists' Union, Baltimore. xiii + 691 pp.

BAILEY, A. M.
1948 Birds of arctic Alaska. Popular Series No. 8, Colorado Museum of Natural History. 317 pp.
DELACOUR, J.
1954 The waterfowl of the world. Vol. 1. Country Life Limited, London. 284 pp.
HANSON, H. C., AND R. H. SMITH
1950 Canada Geese of the Mississippi Flyway. *Ill. Nat. Hist. Surv.*, vol. 25, art. 3, 67–210.
MAYR, E.
1942 Systematics and the origin of species. Number XIII, Columbia Biological Series, Columbia Univ. Press, New York. xiv + 334 pp.
SUTTON, G. M.
1927 Cackling Goose (*Branta canadensis minima*) in southwestern Michigan. *Auk*, 44:559.
WOOD, N. A.
1951 The birds of Michigan. *Misc. Publ. Mus. Zool. Univ. Mich.* No. 75, 559 pp.

BIOLOGY DEPARTMENT, FRESNO STATE COLLEGE, FRESNO, CALIFORNIA, OCTOBER 9, 1958

THE 1956–1957 INVASION OF THREE-TOED WOODPECKERS

BY J. DAVID WEST AND J. MURRAY SPEIRS

THE fall–winter period of 1956–1957 was highlighted by a major flight of Black-backed Three-toed Woodpeckers (*Picoides arcticus*) and Northern Three-toed Woodpeckers (*Picoides tridactylus*) into southeastern Canada and northeastern United States. Southern Ontario and New England were the principal regions involved, although reports were received from an area extending from Minnesota to the Maritime provinces. The flight was undoubtedly the heaviest on record, at least for southern Ontario, where many observers saw one or both of these usually rare birds for the first time.

Prior to 1956, in southern Ontario, individual Black-backed Three-toed Woodpeckers had been noted in the Toronto region nearly every winter. Minor flights, involving perhaps half a dozen birds, had occurred during a few winters. The Northern Three-toed Woodpecker had been reported from the Toronto region only twice prior to the winter of 1956–57. A bird collected in November, 1901, at Well's Hill is in the Royal Ontario Museum; and a second was seen by R. H. Ivor at Erindale on November 17, 1942.

ACKNOWLEDGMENT

We thank all who assisted with records and other information for this paper, and particularly Mrs. Ruth P. Emery, of Boston, Massachusetts, and Mr. James L. Baillie, of Toronto, Ontario, for New England records and for Toronto and Ontario records, respectively. Others who assisted materially were Dr. W. Earl Godfrey, of Ottawa, Ontario; Dr. W. W. H. Gunn, of Toronto, Ontario; Mr. Fred T. Hall, of Buffalo, New York; Mr. Peter J. Hamel, of Hamilton, Ontario; Mr. Christopher M. Packard, of Brunswick, Maine; Mr. Frank R. Pammett, of Peterborough, Ontario; Mr. Chandler S. Robbins, of the U.S. Fish and Wildlife Service, Laurel, Maryland; and Abbé René Tanguay, of St. Anne de la Pocatière, Quebec.

FLIGHT OF NORTHERN THREE-TOED WOODPECKERS

No fewer than eight of these rare woodpeckers were reported from the Toronto region during the winter of 1956–57. The first was found on November 11 at West Hill, scaling the outer bark from the upper branches of a huge elm tree by the side of Highland Creek. A Black-backed Three-toed Woodpecker was working over the same tree, and several observers had the good fortune of seeing both at work side by side. Another which attracted much attention turned up at Glendon Hall, an estate willed to the University of Toronto and within 15-minutes driving time of the main campus. A fine male, discovered at Agincourt on December 30, remained for several weeks, was seen by many observers, and was much photographed. It was subsequently caught by R. R. Taylor, banded, and released.

Most of the reports of the Northern Three-toed Woodpecker in New England were from within its regular range in Maine. However, three were seen in Massachusetts: a pair at Rowley between January 28 and March 31; and a single bird at Milton, in the Boston area, on May 7, one of the late records of this species.

A female Northern Three-toed Woodpecker was seen on December 27, at Genessee Valley Park in New York State. The same bird, possibly, was seen again at Winslow Road, two miles away, on May 11, 1957. This species is decidedly rare in New York State. At Ithaca, it has been observed only once or twice in the past 50 years. A pair was recorded at Raquette, in northern New York, excavating in a spruce on June 10, 1957.

The only report from Michigan was of a specimen collected in the Upper Peninsula in early February, the first taken in the state in many years.

Eight records of this species were received from Quebec, between November 1 (at St. Foy) and May 20 (at Giffard). Both localities mentioned are in the Quebec City area.

From the whole region considered in this report, a total of 59 records of the Northern Three-toed Woodpecker was received (Table 1; Fig. 1). Of these, 28 were from Ontario, only one of which was from within its regular range. There were 16 records from New England, of which four were outside its regular range. The earliest report was on October 28 at Kingston, Ontario, and the latest on June 20 at Pinery Park, Lambton County, in southwestern Ontario.

Seven Northern Three-toed Woodpeckers were reported on the 1956 Christmas counts.

Flight of Black-backed Three-toed Woodpeckers

About five Black-backed Three-toed Woodpeckers were reported for every Northern Three-toed Woodpecker. The total was 293 (compared with 59 Northern), of which 114 were from Ontario and 98 from New England. (See Table 2 and Fig. 2.) There were 32 reports from Quebec, two from New Brunswick, and one from Nova Scotia. New York State had 38 reports, and single birds were reported from New Jersey, Pennsylvania, and Minnesota. Illinois and Wisconsin each reported two, and three reports came from Michigan.

The most southerly records are from Culver's Gap, New Jersey, where one was reported on October 22; Point Pelee, Ontario, October 27; Rockford, Illinois, December 9; Pymatuning Reservoir, March 23 (the first record for western Pennsylvania), and Mill Neck, Long Island, in mid-February. The two seen in Wisconsin, one on October 28 and the other on November 25, were the first reported to the Wisconsin Society for Ornithology since 1951.

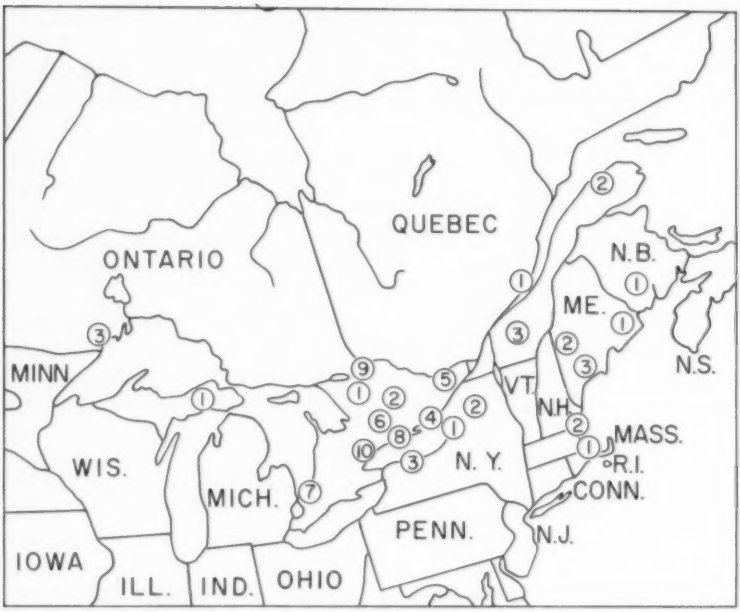


FIG. 1. Records of the Northern Three-toed Woodpecker. Places or areas in each state or province from which records were received are numbered and are listed chronologically in Table 1.

The earliest report received was from Ste. Felicité, Quebec, where a family group of five was seen on August 8, 1956. This, however, was prior to the flight proper, which was first noted (also in Quebec) at Quebec City, where one was seen on September 8 and two on September 22. Another early September report was from Brier Island, Nova Scotia, where a female was banded by Harrison F. Lewis.

The first Ontario report, on September 25 at Barrie, was followed by reports from Commanda, Toronto, and Kingston, in early October. Numerous observations followed, up to early December; they then tapered off sharply, but birds were reported every month up to June 2, at Pickering, in the Toronto area.

The first New England record was at Monhegan Island, Maine, on September 26. On September 29, a specimen was found dead at Haverhill, the first record of this flight for Massachusetts. Of a total of 56 records received from this state, most were in the eastern section. One of the Massachusetts birds

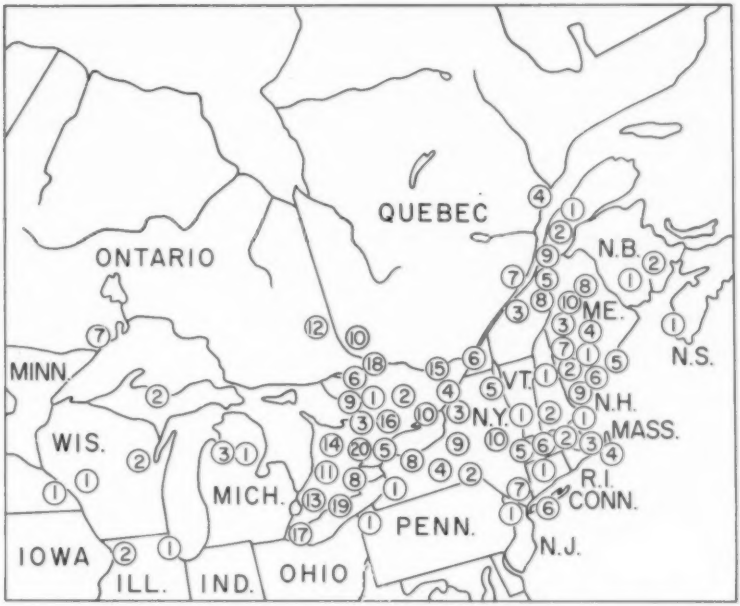


FIG. 2. Records of the Black-backed Three-toed Woodpecker. Places or areas in each state or province from which records were received are numbered and are listed chronologically in Table 2.

was reported from Nantucket, 30 miles off the southeast coast. A bird at Hyde Park, south of Boston, on August 10, 1957, apparently was a left-over from the flight. This was the latest report received from any locality in the flight area. Previously, a major New England flight occurred in the years 1923–1926. Only five records of the species were obtained in the intervening years by the Massachusetts Audubon Society.

The first New York State report was on October 11 at Chenango Valley State Park, and the first for western New York, at Wilson on October 20. Thirty-eight reports were obtained from New York, the Genessee Valley region being the most productive. The normal occurrence of this species at Rochester is one bird every five to ten years.

Thirty-one Black-backed Three-toed Woodpeckers were reported on Christmas counts, including eight at Toronto and five at Rochester.

A great many of the reports stated that individuals of both species were seen on elm trees. In the Toronto region they worked over the elms as high

up as scaly bark was available. This they chipped off, revealing the fawn-colored inner bark. The report from Buffalo, New York, suggested that the attraction may have been the *Scolytus* beetle, a vector of Dutch elm disease.

The heavy flight of Black-backed Three-toed Woodpeckers of 1923–24 in New England was fully reported by Josselyn Van Tyne (1926. *Auk*, 43:469–474). He attributed it to a big population built up in eastern Canada and Maine, resulting in part at least from the activities of the spruce budworm, which had devastated large areas in those regions between the years 1909–1914. Subsequent tree mortality was heavy and was apparent as late as 1924. The dead trees provided ideal conditions for bark beetles and borers, upon a diet of which the three-toed woodpeckers flourished and increased.

The disastrous forest fires of 1955 may have been a contributing factor in bringing about the 1956–1957 flight.

TABLE 1

NORTHERN THREE-TOED WOODPECKER RECORDS

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
	MAINE			
1	Charlotte	March 1	A. E. Davis	1
2	Franklin County			
	Langton Township	Nov. 11	Emery	2
		Nov. 12	Emery	8
	Eustis	Feb. 26	Townsend	1
3	Sidney	Nov. 10	Emery	1
	MASSACHUSETTS			
1	Milton	May 7	Charles Ewing	1
2	Rowley	Jan. 28–30	Mrs. C. de Windt, *et al.*	1 ♀
		Feb. 2–March 31	*fide* Ruth P. Emery	1 ♂
	MICHIGAN			
1	Luce County			
	McMillan Township	Feb. 3	Robert S. Butsch	1 ♂ (specimen)
	NEW BRUNSWICK			
1	Fredericton	Nov. 2	W. A. Squires	1
	NEW YORK			
1	Fisher's Landing	March 10	Allen	1
2	Raquette	June 10	Roberta Seamen, *et al.* (*Audubon Field Notes*, Aug., 1957)	2
3	Rochester area			
	Genessee Valley Park	Dec. 27–March	Muchmore, *et al.*	1 ♀
	Winslow Road	May 11	Starling, Bruner	1 ♀
	ONTARIO			
1	Algonquin Park area			
	Lake Sasajewan	Nov. 3	G. Gibson	1
	Huntsville	Dec. 23	R. J. Rutter	2
	Bella Lake	Jan. 3	C. N. Ireson	1 ♂
2	Bancroft area			
	McGarry's Creek	Jan. 13	D. E. Scovell	1 ♂
	Bancroft	Feb. 9	D. E. Scovell	1 ♀

TABLE 1 (Continued)

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
3	Fort William	Dec. 30	Keith Denis	1
4	Kingston area			
	Kingston	Oct. 28	Arthur Bell	1 ♀
	Bedford Mills	Nov. 10	Alden Strong	1 ♀
5	Ottawa area			
	Ottawa	Late Nov.	acc. to W. Earl Godfrey	1
	Almonte	Dec. 2	W. Earl Godfrey	1
6	Peterborough area	Nov. 3	R. K. Baker, F. R. Pammett	1 ♀
		Nov. 18	R. K. Baker	1 ♂
		Dec. 26	R. K. Baker, F. R. Pammett, D. Sadler	1 ♂
		Feb. 17	R. K. Baker, F. R. Pammett	1 ♂
		April 21	R. K. Baker	1 ♂
7	Pinery Park, Lambton County	June 20	Dr. Keith Reynolds, *et al.*	1 ♂
8	Port Hope area			
	Port Hope	Early Dec.	R. Burness	1
	Canton	ca. Dec. 25	*fide* P. Landry	1
9	Rutherglen	May 16–June 10	Louise de Kiriline Lawrence	1 ♂
10	Toronto area			
	Highland Creek	Nov. 11	G. Fairfield	1 ♀
	Ajax	Nov. 11	W. Campbell	1 ♂
	Glendon Hall	Nov. 17	D. Bryant, E. Waltho, L. Hughes	1 ♀
	Agincourt	Dec. 20	G. Page, R. Wilson	1 ♀
	Port Credit	Dec. 21	Mrs. L. McDougall	1
	Scarboro	Dec. 23	W. Martin	1
	Donalda	Dec. 25	W. Hough	1 ♂
	Agincourt	Dec. 30	J. L. Baillie, *et al.*	1 ♂
	QUEBEC			
1	Quebec City area			
	Ste. Foy	Nov. 1–4	Gaston LePage	1
	Cape Tourmente	Nov. 13	acc. to René Tanguay	3
	Valcartier	Dec. 11	acc. to René Tanguay	1
	Giffard	May 20	Benoit Asselin	1
2	Ste. Anne des Monts	April 6	Frère Charles-Aimé	1
3	Ulverton	March 22	L. M. Terrill	1

TABLE 2

BLACK-BACKED THREE-TOED WOODPECKER RECORDS

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
	CONNECTICUT			
1	New Canaan	Aug.–Oct. 1956	C. Bartow (*Audubon Field Notes*, Feb., 1957)	1
	New Britain	Oct. 9–28	Edwin Austin	2
	Glastonbury	Nov. 18	Dr. Whittles	1
		Nov. 21	Dr. Whittles	1
	West Hartford	Jan. 11	*fide* Mrs. Mary French, *et al.*	1
	New Britain	Feb. 7–April 6	Edwin Austin	1
	ILLINOIS			
1	Chicago	April 28–May 19	Allen C. Montague, (*Audubon Field Notes*, Aug., 1957)	1♀
2	Rockford	Dec. 9	R. Earl Olson	1♂
	MAINE			
1	Androscoggin County			
	Webster	Feb. 24	D. H. Morse	1♀
		March 30	D. H. Morse	1♂
2	Cumberland County			
	Bridgton	Nov. 22	Edgerton	1
	Gorham	Jan. 17	Poole	1
3	Franklin County			
	Coburn Gore	Feb. 22	De Garmo	1♀
	Eustis	April 20	Therrien	1
	Wilton	April 24	Fernald	1♂
4	Kennebec County			
	Augusta	Nov. 4	Southard	1
	Farmingdale	Dec. 28	Emery	1
5	Knox County			
	Monhegan Island	Sept. 26	Lawrence	1
	St. George	Oct. 6–12	Hanneman	2♂
6	Lincoln County			
	Pemaquid Point	Oct. 12	Mrs. Phillip L. Holden	2
7	Oxford County			
	Baldpate Mountain	Sept. 29	Miss S. Wolfaston	1♀
8	Piscataquis County			
	Mount Katahdin	Oct. 12	Tabers	2

TABLE 2 (Continued)

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
9	Sagadahoc County			
	Bath	April 22	Emery	1
10	Somerset County			
	Brighton	Nov. 14	Gamage	1
	Pleasant Ridge Plt.	Nov. 23	Gamage	1
	Rockwood	March 1	Foss	1♀
	The Forks	April 28	N. L. Davis	2
	Moose River	April 28	N. L. Davis	1♀
11	Washington County			
	South Addison	Oct. 19	Ewers	1♂
	MASSACHUSETTS			
1	Essex County			
	Haverhill	Sept. 29	Mrs. H. Cole	1 (specimen)
	Manchester	Oct. 13	Mr. and Mrs. John Day	2
	Andover	Oct. 25	Craig Roberts, W. Byers	1♂
	North Andover	Oct. 31	Brian Harrington	1♀
	Magnolia	Nov. 19	Mrs. Edwin S. Rand	1
	North Andover	Dec. 7	Craig Roberts	1♀
	Hamilton	Jan.	R. Ames, *et al.*	1
	Rowley	Jan. 27	Ruth P. Emery	1♂
	Newburyport	Feb. 2–Feb.28	C. DeWindt, E. Barry	2
	Annisquam	Feb. 27	Mr. and Mrs. R. L. Gaffney	1
	Newburyport	March	*fide* Ruth P. Emery	1♀
	North Andover	March 2	Torrey Jackson, John B. Holt, Jr.	1♂
	Newbury	April 12	C. DeWindt	1
	North Andover	May 5	Oscar M. Root	1♂
2	Middlesex County			
	Lexington	Oct. 6	Mr. and Mrs. F. Cutler	1♀
	Hudson	Oct. 22	Mrs. Parker	1
	Winchester	Oct. 27	Mrs. D. W. Kitchin	1
	Hopkinton	Oct. 23	Adelbert Temple	1♀
	Weston	Nov. 15	R. Campbell	1
	Concord	Mid-Dec.–Jan. 27	Mrs. Standish Bourne	2
		Feb. 16	T. R. Morse	1♀

TABLE 2 (Continued)

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
	Framingham	Feb. 23	F. Gleason	1
	Weston	March	Jean Wittenberger	1 ♀
		March 24	Stephen Cribben	1
	Sherborn	April 6	Mr. and Mrs. H. M. Channing	1 ♀
	Lexington	April 23	Mrs. A. H. Meyer	1 ♀
	Concord	May 7	Mary McClintock	1
3	Norfolk County			
	Wellesley Hills	Oct. 14–Nov.25	Wayne Peterson, Mrs. P. L. Holden, K. Elkins	3
	Needham	Dec.	John Willison	1
	Dover	Dec. 16–18	Chas. C. Cabot, *et al.*	3
	Wollaston	Feb. 11	Robert Fox	1 ♀
	Wellesley	March 13–20	Mrs. A. Edmands	2 ♀
	Milton	April 13	Sarah H. Wollaston	1 ♀
	Hyde Park	Aug. 10, 1957	Leon Berig	1 ♂
4	Southeast Massachusetts			
	Nantucket	Oct. 21	John V. Dennis	1 ♂
	Cataumet	Oct. 27	E. C. Johnson	1
	Westport	Dec. 1	Norman Hill	1 ♂
	Berkley	April 18	Mrs. Athearn, *et al.*	2
5	Western Massachusetts			
	Holyoke	Dec. 30	Rudolph Stone	1
	Northfield	Feb. 2	Mr. and Mrs. David A. Pepperell	1 ♀
	Mt. Tom	March 15 and 16	S. A. Eliot, *et al.* (*Audubon Field Notes*, Aug., 1957)	1
6	Worcester County			
	Worcester	Oct. 31	Mrs. Phillip B. Haywood	1 ♀
	Rutland	Dec. 1	Mr. and Mrs. Davis H. Crompton	1 ♂
	Barre	Dec. 7	Davis H. Crompton, David Miner	1 ♂
	Paxton	Dec. 9	Lloyd Jenkins, *et al.*	1 ♀
	Barre	Dec. 16	Davis H. Crompton, David Miner	1 ♀
		May 8	Campbell	1 ♀
	MICHIGAN			
1	Luzern	Nov. 19	L. M. Zimmerman	1
2	Marquette	Feb. 13	Ed Wieland	1

TABLE 2 (Continued)

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
3	Kirtland's Warbler Country (First nesting record for the lower peninsula of Michigan)	May 31	Harold Mayfield	Nest with young
	MINNESOTA			
1	Winona	May 4	John Futcher	1
	NEW BRUNSWICK			
1	Fredericton	Early Nov.	*fide* W. A. Squires	1
2	King's County	June 19	(*Nature News* [N. B. Museum], 8[4]:2, July–Aug., 1957)	nest
	NEW HAMPSHIRE			
1	Northern New Hampshire			
	Monroe	Oct. 25–26	Ruby B. Emery, Priscilla Powers	1♀
	Littleton	Dec. 2	Ruby B. Emery	1♀
	Lancaster	Jan. 27	Mr. and Mrs. Wm. F. Nickerson	1
	Pinkham Notch	Feb.	Miss F. Lawson	1
2	Southern New Hampshire			
	Nottingham	Oct. 20	Mr. and Mrs. N. L. Hatch	1
	Hollis	Oct. 21	W. H. Stimson	1♀
	Peterboro	Nov. 8–Dec. 20	W. Patten Hill	2
	New Hampton	March 1	R. Hebert	1
	NEW JERSEY			
1	Culver's Gap	Oct. 22	F. W., *et al.*, (*Audubon Field Notes*, Feb., 1957)	1
	NEW YORK STATE			
1	Buffalo Region			
	Wilson	Oct. 20	Dr. and Mrs. H. Axtell	2
	Letchworth Park	Oct. 28	Clayton Knox	1♀
		Nov. 4	Mr. and Mrs. E. Ulrich, *et al.*	1♂
	Olean	Nov. 24	Charles Summers	1
	Buffalo	Dec. 9	T. Ucci, Gertrude Webster	1
		Dec. 16	Walker, Gertrude Webster	1
	Armor	April 10	Mrs. Milligan, Mrs. J. Bacon	1
2	Chenango Valley State Park	Oct. 11	Robt. Saunders, *et al.*	2♂
3	Clayton area	Dec.–March 10	Belknap, A. W. Allen	2

TABLE 2 (Continued)

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
4	Finger Lakes area			
	Sapsucker Woods Pond	Mid-Jan.	David Allen	1
	Ithaca	Feb. 2	per Cornell Ornithology Laboratory	1
5	Keesville	Dec. 8	T. A. Lesperance	1 (specimen)
6	Mill Neck	Mid-Feb.	John Elliott	1 ♂
7	New York City area			
	Bedford	Oct. 20	Douglas Orbison, *et al.*	1
	New Rochelle	April 28	George Gorman	1 ♂
8	Rochester area			
	1105 Monroe Ave.	Nov. 18–April	Stutz, Klonick, *et al.*	4♀, 3♂
	Scottsville	Nov. 23	O'Hara, Miller	1♀
	Summerville Drive	Dec. 30	Whites	1♀
	Morville Drive	Jan. 2–10	Leo Tanghe	1♀, 1♂
	Long Pond Woods	April 27	O'Hara, Miller	1♀
9	Syracuse area			
	Ava	Dec. 1	A. Jones	1♂
	Fayetteville	Dec. 30	Walter Spoffard	1
	Manlius	Mid-Jan.	*fide* Mrs. R. Gould	1♀
	Baldwinsville	Feb. 17–March 10	F. Scheider, Evans	1♀
		Feb. 24	Mr. and Mrs. J. Smith, *et al.*	1♂, 2♀
10	Watervliet	Dec. 22–Jan. 20	James Merritt	1♀
	NOVA SCOTIA			
1	Brier Island	Early Sept.	Harrison F. Lewis	1♀ (banded)
	ONTARIO			
1	Algonquin Park	Oct. 27	J. L. Baillie, E. V. Stark, *et al.*	1
2	Bancroft area			
	Paudash Lake	Jan. 5	D. E. Scovell	1♀
	McGarry's Creek	Jan. 13	D. E. Scovell	1
3	Barrie area	Sept. 25	Mrs. J. MacLean	1
		Nov. 9	Mrs. J. L. Westman	1
		May 13	L. Whiting	1
		May 18	Mrs. E. S. Lewis, *et al.*	1♂, 1♀

TABLE 2 (Continued)

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
4	Brockville area	Nov. 4	D. S. Hurrie	1♀
		Dec. 29	J. Cartwright, S. Wilsie	1
		Jan. 1	D. S. Hurrie	1♂
		Jan. 12	D. S. Hurrie	1♂
5	Cobourg area			
	Brighton	Oct. 19	A. A. Outram	1
	Port Britain	Oct. 26	H. Reeve, L. Steele	1
	Port Hope	Oct. 27	R. Burness	1
	Rice Lake	Early Nov.	Eleanor Ralls	1
	Presqu'ile Point	Nov. 11	Miss A. M. Hughes, *et al.*	1♂
		Dec. 16	G. Bennett	1
	Cobourg	Dec. 23	Willow Beach Field Nat. Club	1
	Port Hope	Dec. 23	Willow Beach Field Nat. Club	2
	Grafton	Jan. 6	Miss A. Wilson	1
	Cobourg	Feb. 10	G. Bennett	1♂
6	Commanda	Oct. 6–13	Paul Harrington	Flight of 4–5 daily
7	Fort William–Port Arthur	Dec. 26	Keith Denis	1
8	Hamilton area			
	Paradise Rd.–Hwy. #53	Oct. 21–Dec. 1	R. Roy, G. W. North	1
	Strathearne Sewer	Oct. 21–27	H. McPherson	1
	Dundas Marsh	Nov. 17	H. Williams, J. Cummings	1
	Spencer's Creek	Nov. 25	G. W. North, J. Miles	1
	Dundas Marsh	Dec. 1	W. A. T. Gilmore	2
	Westdale	Dec. 9	R. Henry	1
	Mount Albion	Dec. 16	R. Seargent	1
	Sherman St.	Dec. 30	J. Miles	1
	Clappison's Corners	Dec. 30	H. Williams	2
	York Road	Jan. 12	J. Miles	1
	Campbellville	Feb. 2	*fide* P. Hamel	1
	McKittrick's Bridge	Feb. 10	Hamilton Junior Nature Club	1
	Freeman & Westdale	March 1	S. McBride, H. McPherson	2
9	Huntsville	Dec. 23	R. J. Rutter	1

TABLE 2 (Continued)

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
10	Kingston area			
	Kingston	Oct. 9	Helen Quilliam	1♂
	Westport	Late Oct.	A. Strong	1♀
	Bedford Mills	Nov. 10	A. Strong	1♂
	Kingston	Dec. 16	A. E. Garwood, W. Lamb	1♀
11	Kitchener	Nov. 17	Margaret Lemon	1♀
12	Kirkland Lake	Christmas census	J. G. Stephenson	1
13	London	Dec. 2	James Leach, *et al.*	1
14	Orangeville area	Oct. 15	Isobel Miller	2
15	Ottawa area	Fall 1956	*fide* W. Earl Godfrey	Several
		March 1	D. B. O. Saville	1
		April 4	D. B. O. Saville	1
16	Peterborough area	Oct. 28	A. Bunker, F. R. Pammett, J. L. McKeever	1♀
		Nov. 4	D. Sadler, F. R. Pammett	1♂,1♀
		Nov. 18	R. K. Baker	1♂,2♀
		Dec. 26	R. K. Baker, F. R. Pammett, D. Sadler	1♂,2♀
		Feb. 9	R. K. Baker	1♂
		April 19	F. R. Pammett	1♀
		April 21	G. C. Green	1♂
17	Point Pelee	Oct. 27	R. E. Mara	1
18	Rutherglen	Fall, 1956	Louise de Kiriline Lawrence	3
19	St. Williams	April 19	Mr. and Mrs. R. Lloyd	1
20	Toronto area			
	Willowdale	Oct. 4	W. Wasserfall	1♀ (banded)
		Oct. 11	W. Wasserfall	1♂ (banded)
	Colborne Lodge	Oct. 14	W. Higgins	1♀
	Glen Major	Oct. 14	Mrs. O. S. Mitchell	1
	Woodbridge	Oct. 14	W. Williams	2
	Pottageville	Oct. 21	L. L. Snyder	1
	Richmond Hill	Oct. 23	Mrs. Curry	1
	Finch Ave., North York	Oct. 24	W. Williams	1♂
	Pickering	Oct. 27	R. M. Saunders	1
	Applewood Acres	Oct. 28	J. Dales	1
	Lawrence Ave. E	Oct. 28	Miss McGregor	1

TABLE 2 (Continued)

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
	Purpleville	Oct. 28	Mrs. A. J. Ballinger	1♀
	Sunnybrook Hospital	Oct. 30	L. Hughes	1
	Willowdale	Early Nov.	W. Wasserfall	1♀ (banded)
	Glendon Hall	Early Nov.	E. Waltho	1
	Port Credit	Nov. 1	Mrs. D. R. Gunn	1
	Green River	Early Nov.	Mrs. P. Applegath	1
	Highland Creek	Nov. 4	J. Smith	1♀
	Royal Ontario Museum Grounds	Nov. 7	Sylvia Hahn	1
	College Street	Nov. 7	F. Darroch	1
	Bayview Ave.	Nov. 8	C. Atwood	1
	Richmond Hill	Nov. 11	*fide* L. L. Snyder	1
	Lorne Park	Nov. 11	D. R. Gunn, D. Perks	1
	Cherrywood	Nov. 12	M. Armstrong	1
	Port Credit	Nov. 13	D. R. Gunn	1♀
	Purpleville	Nov. 17	Mrs. D. Lewis	1♂
	Glendon Hall	Nov. 22	J. R. Mackintosh	2♂
	Bloor St. W.	Nov. 22	R. W. Trowern	1
	Cedarvale	Nov. 24	R. Pannell	1♀
	Glendon Hall	Nov. 27	J. Livingston, R. T. Peterson, J. L. Baillie	1♀
	Ajax	Dec. 2	W. Campbell	1 (banded)
	Lorne Park	Dec. 23	J. L. Baillie, *et al.*	4
	Smythe Park	Jan. 5	G. Giles	1♂
	James Gardens	Jan. 5	G. Giles	1
	Cooksville	March 20	Mrs. Houghton	1
	Thistletown	April 21	David Moore	1♀
	Applewood Acres	April 28	J. Dales	1
	Highland Creek	May 4–6	J. Smith	1♂
	Willowdale	May 5–11	W. Wasserfall	1
	Pickering	June 2	R. Taylor, D. O'Brien	1
	PENNSYLVANIA			
1	Pymatuning Reservoir	March 23	Hal H. Harrison	1

TABLE 2 (Continued)

Map Reference No.	Locality	Date	Observers	Number (Sex if given)
	QUEBEC			
1	Barriére Caribou	Sept. 27	*fide* Abbé René Tanguay	1
		Oct. 12	*fide* Abbé René Tanguay	1
2	Biencourt	May 16	Henri Ouellet	1
3	Dosquet	March 13	*fide* Abbé René Tanguay	1
4	Ilets Jeremie	Sept. 4–5	Jacques Normandin	2
5	Lac Frontière	Oct. 18	Louis Amédée Lord	2
6	Montreal region			
	Montreal	Oct. 5	Paul Lebouet	1
	Senneville	Nov. 7–April 23	R. S. and P. C. Abbott	1♀
	Hudson Heights	Dec. 30	Mrs. G. A. Golden	1
	Rigaud	March 21	Cercle Jeune Naturalistes	1
7	Quebec City region			
	Quebec City	Sept. 8	Ronald LePage	1
		Sept. 22	*fide* Abbé René Tanguay	2
		Oct. 5	*fide* Abbé René Tanguay	1
	Montmorency	Nov. 11	Francois Hamel	1
	Valcartier	Nov. 11–March 20	*fide* Abbé René Tanguay	2
	Quebec City	Nov. 13	*fide* Abbé René Tanguay	1
	St. Foy	Nov. 25	Gaston LePage	1
	Quebec City	Dec. 1	Ronald LePage	1
		Dec. 29	Raymond Cayouette	1
	Valcartier	March 20	*fide* Abbé René Tanguay	1
	Notre Dame des Laurentides	March 20	Abbé Paul Etienne Sirois, Lucien Robitaille	1
8	St. Fabien de Panet	Dec. 28	Raymond McNeil	1♂
9	Ste. Felicité	Aug. 8, 1956	Raymond Cayouette, *et al.*	Family group of five
10	Temiscamingue	Feb. 8	*fide* Abbé René Tanguay	1♀
	VERMONT			
1	Okemo Mountain	Oct. 21	Elizabeth Ball	1
	WISCONSIN			
1	Jackson County	Nov. 25	Alan J. Rusch	1♂
2	Oconto County	Oct. 28	Carl H. Richter	1

BIRDS OBSERVED DURING TWO ATLANTIC CROSSINGS

BY R. HAVEN WILEY, JR.

EVEN though a number of excellent papers have been written on pelagic birds of the North Atlantic, there is still a definite need for more information on their distribution. I have recently made two Atlantic crossings between the United States and Europe. This paper consists of my observations of oceanic birds on these voyages and should help to fill some of the gaps in our present knowledge of these birds.

The eastbound crossing in 1957, made on H.M.S. *Queen Elizabeth* from New York to Cherbourg, France, took over four and a half days to complete. The ship left New York Harbor at 11:00 a.m. (E.S.T.), July 11, and docked at Cherbourg at 8:00 a.m. (Cherbourg time), July 16. The course the ship followed was roughly east from New York to 34° West longitude, northwest of the Azores, and then a gradual curve northeast into the English Channel to Cherbourg. The weather was mild for most of the trip. July 12 and the morning of July 14 were overcast with occasional rain, and on the 15th there was a light fog most of the day.

The crossing on the way back in 1958 was made on the S.S. *United States* from Southampton, England, via Le Havre, France, to New York. The steaming time from Le Havre to New York was four days and eight hours from 1:30 a.m. (Le Havre time), August 15, to 8:30 a.m. (E.S.T.), August 19. The course of the westbound crossing was considerably north of the eastbound crossing. From Le Havre the ship followed a gradual curve west and south to approximately 48° West longitude and 41° North latitude. From there it sailed directly to New York (the noon positions for both voyages are given in Table 1). The weather on this trip was similar to that of the preceding one. The morning of August 16 and up to 10:00 a.m. on August 17 were the only overcast periods with the exception of a heavy fog on the afternoon of the 17th.

I have found no previous record of observations on oceanic birds from a ship of this size or speed. Mayr (1938:54) states that ". . . it seems impossible to make satisfactory sea-bird observations on steamers which do much more than 20 knots." However, the *United States* and the *Queen Elizabeth* had cruising speeds of approximately 30 and 27 knots, respectively.

On both trips all my time spent observing birds was from the bow of the ship. I have no means of knowing what species, if any, followed in the wake of the ship. This may have affected the numbers I saw of certain oceanic birds (e.g., Wilson's Petrel, Fulmar) which are reported to follow in the wakes of ships. In the bow of the ship I frequently changed from one side to the other. Except in the few areas where birds were abundant and passing in large

TABLE 1

NOON POSITIONS AND THE NUMBER OF BIRDS SEEN PER HOUR

Voyage	Date	Noon Position	Hours of Observation	Total No. Birds Seen
East	July 11	South of Long Is.	2	6
(1957)	July 12	40° 42′N., 60° 02′W.	5	27
	July 13	41°N., 44°W.	3	1
	July 14	44°N., 29°W.	7	147
	July 15	49°N., 15°W.	3	4
West	Aug. 15	49° 51′N., 08° 29′W.	4	6
(1958)	Aug. 16	48° 38′N., 28° 45′W.	7	115
	Aug. 17	44° 06′N., 46° 56′W.	5	84
	Aug. 18	41° 21′N., 63° 35′W.	4	66

numbers on both sides of the ship at once, I saw nearly all the birds that the ship passed while I was on deck. I used 7× binoculars almost exclusively. On one occasion I tried using a 20× telescope; however, this proved to be unsatisfactory from the moving deck of a ship. I found that the binoculars sufficed in nearly all cases.

On the eastbound voyage I averaged four hours per day observing birds, and five hours per day on the westbound voyage. The exact hours for each day are given in Table 1. On the days when birds were numerous I generally spent more time on deck than on the days when they were scarce. This explains the day to day variation shown in the table. I spent a total of forty hours on deck during both voyages. I kept the exact time that each bird was observed in order that its location could be found.

TABLE 2

NUMBERS OF THE MORE COMMON SHEARWATERS AND PETRELS

Species	Eastbound Crossing					Westbound Crossing			
	July					August			
	11	12	13	14	15	15	16	17	18
Puffinus gravis	—	20	—	50	—	—	56	9	—
Puffinus diomedea	1	—	—	72	2	—	14	4	2
(Unidentified shearwaters)	—	5	—	—	1	1	8	16	—
Oceanodroma leucorhoa	—	—	—	15[1]	—	—	—	3	9
(Unidentified petrels)	—	—	1	—	—	—	1	49	52

[1] Possibly **O. castro** (see text).

Acknowledgment

I wish to express my appreciation to Professor V. C. Wynne-Edwards for his criticism of this paper. I am very much indebted to him for his help and encouragement.

Systematic List

The following is a systematic list of the birds I observed out of sight of land on two Atlantic crossings:

Fulmar (*Fulmarus glacialis*).—Two light-phase Fulmars were seen resting on the water in a heavy fog on August 17, 1958, off the southern tip of the Grand Banks at 43°N. 50°W. The two birds were about three and a half nautical miles apart. Wynne-Edwards (1935: Fig. 12) shows the range of *F. glacialis* on the Grand Banks in July to be no farther south than about 47°N. Rankin and Duffey (1948: Fig. 6), however, do include the southern tip of the Banks in the summer distribution of this species. My observations support Rankin and Duffey's distribution of this species on the Banks but not in mid-ocean. These authors show (Fig. 6) *F. glacialis* ranging south of the 50th parallel west from 15°W. from April to September. However, I saw no *F. glacialis* on August 16 when the *United States* was sailing just south of 50°N.

Cory's Shearwater (*Puffinus diomedea*).—On both crossings this species was ordinarily seen only in small numbers. The only occasion on which it was common was the afternoon of July 14 on the eastbound voyage when over 60 shearwaters of this species were seen, including two flocks of over 15 individuals and several smaller groups. *P. gravis* was entirely absent from the area. On the 1957 trip individuals of *P. diomedea* were observed near both the American and European coasts. On July 15 two shearwaters identified as this species were seen at 48°N. 14°W. and 48½°N. 12°W. respectively, and on the 11th an individual was observed south of Massachusetts at 41°N 71°W. This is an early record for this species in the western Atlantic. Wynne-Edwards (1935:267) mentions that *P. diomedea* does not reach American waters until early August. Gordon (1955:141) found them off southern New England no earlier than July 18 in 1953. However, two early sight records of this species for 1957 were published in *Audubon Field Notes*. (1) Baird and Emery (1957:388) reported two Cory's Shearwaters seen by W. Bailey off Monomoy, Massachusetts, on June 29. (2) Nichols (1957:390) reported 170 observed by P. Buckley off Mecox Bay, Long Island, on July 8. In 1957 there appears to have been an early wave of *P. diomedea* to the southern New England and Long Island coasts. On the westbound crossing the easternmost shearwater of this species was seen at 48½°N. 59°W. and the westernmost individual at 41½°N. 59° W. Both of these positions are over 400 nautical miles farther west and east respectively than the extreme observations on the eastbound voyage.

Greater Shearwater (*Puffinus gravis*).—This species of shearwater was seen frequently in mid-ocean on both crossings. My records generally agree with the range of this species given by Wynne-Edwards (1935: Figs. 5 and 6). The shearwaters seen on July 12 and 14 indicate that *P. gravis* occurs as far south as 40°N. in the western Atlantic and 44°N. in mid-ocean at least up to the second week of July. Wynne-Edwards (1935: Fig. 5) shows that this shearwater is already slightly north of these areas by June 25. On the westbound crossing my observations agree even more closely with this author. In his Fig. 6, Wynne-Edwards shows that the southern limit of *P. gravis* on August 10 approximately corresponds with the 50th parallel. On August 16 at 48½°N. over 50 of these shearwaters were seen, while the next day when four degrees farther south only nine were observed. I never

observed any large flocks of this species of shearwater. Actually, they were most often seen singly or in pairs. The exceptions were a group of nine in the afternoon of July 12, six or seven flocks of shearwaters on the morning of July 14, the three largest of which included over ten *P. gravis* each, and eight shearwaters some of which were this species observed in a flock on August 18. The flocks on July 14 and the one on August 16 all included a few *P. diomedea.*

On the westbound crossing a single *P. gravis* flew along with the bow of the liner at some distance off the beam for ten minutes, having no trouble keeping up with the ship which had a cruising speed of 31 knots. For flight it relied entirely upon the 15 mph wind, flapping only twice during the ten minutes. An individual of this species of shearwater flying at a speed of 15 knots kept up with the ship from which Wynne-Edwards made his observations (Wynne-Edwards, 1935:248). This is the only other record of the flight speed of a shearwater in the North Atlantic that I have been able to find.

I had little trouble separating the present species from *P. diomedea.* I found that the dark, sharply contrasting cap was by far the easiest way to identify *P. gravis.* Other field marks that I used included the conspicuous white patch at the base of the tail, the dark bill, the dark abdomen patch (though it was difficult to observe), and the smaller size when the two species were seen together. The light-colored bill of *P. diomedea* was often noticeable on birds in good light.

Manx Shearwater (*Puffinus puffinus*).—On August 15 three of this species were seen. A single bird was observed 75 nautical miles and two others 195 nautical miles west of the Scilly Isles. All three birds flew under the bow permitting close observation. They were all presumably *P. p. puffinus* but were certainly not the subspecies with darker underparts, *P. p. mauretanicus,* which occurs in the English Channel from June to September (see Nicholson, 1952:51).

Audubon's Shearwater (*Puffinus lherminieri*).—On the westbound voyage in 1958 I observed two together and three single shearwaters that were undoubtedly of this species on August 18 at 41°N. 60°–61°W. Their characteristic flight and smaller size distinguished them from *P. puffinus,* which has the same contrasting color pattern. A distinct brownish hue was seen in excellent light at close range on the upperparts of these five shearwaters. This, according to Murphy (1936:682), is one of the characteristics distinguishing the present species from the Little Shearwater (*P. assimilis*), whose upper surface is slate-colored ". . . without a trace of brownish hue in fresh feathers." *P. assimilis* is the only other small North Atlantic shearwater with a similar flight. In 1957 three shearwaters that appeared to be small enough for *P. lherminieri* were seen at 40°N. 56°W. on July 12. Since their flight was not noticed, there is a possibility that they were *P. puffinus.* These three individuals were in the company of nine *P. gravis.* The color of the under tail-coverts was not seen on any of the birds.

The distinctive flight of *P. lherminieri* is the most noticeable characteristic distinguishing it from the larger *Puffinus* shearwaters. The present species during flight alternates short glides with nearly equal periods of rapid flapping, dividing its flight into a regular pattern. I found that the number of wing strokes between glides varied between five and 15, though less than eight flaps was unusual. *P. puffinus* and the other larger shearwaters are more accomplished at gliding and banking, only taking one or two occasional flaps at irregular intervals. Lockley (1947:15) describes the banking flight of *P. puffinus* in relatively calm weather as ". . . careening from side to side, now skimming the water for fifty yards with one wing-tip, then rising to about ten feet above the surface, beating its wings once or twice or thrice to gather a fresh momentum, then skimming the sea for a similar distance with the other wing down." Several authors mention this difference in the

flight of these two groups of shearwaters. Among them are Peterson (1947:246) and Alexander (1955:28).

I have been able to find very few published records of *P. lherminieri* in the North Atlantic. There are only two positive identifications by authors. A single bird was seen on November 22 at approximately 50½°N. 40°W. by R. L. Grayce (1950:34), who includes no details of plumage or behavior other than that it was in the company of hundreds of *Fulmarus glacialis*. The second identification was of several shearwaters of this species seen off South Carolina and Florida in January and February, 1912 and 1913, by J. T. Nichols (1913:506–508). M. S. Gordon (1955:140) identified some small shearwaters that were almost certainly this species off southern New England in 1953. Two shearwaters which could not be distinguished as to whether they were *P. lherminieri* or *P. assimilis* were seen by Rankin and Duffey (1948:10) in mid-ocean, one in August and the other in December. Along the American coast this species occurs occasionally as far north as Massachusetts. Off southern New England Gordon (1955:141) first found *P. lherminieri* on August 6 when a single bird was seen four miles southwest of Martha's Vineyard. By late August they had become the most numerous shearwater between 39½°N. and 40°N., south of Massachusetts. These records along with my own indicate that in August the range of this species extends as far north as 41°N. and as far out as 60°W. from the American coast, and possibly even to 38°W. if Rankin and Duffey's observation is of this species. However, there are not adequate data to make even these assumptions. Many more specimens and reliable sight records are needed to determine the oceanic range of *P. lherminieri*.

Leach's Petrel (*Oceanodroma leucorhoa*).—This species was the most common of all the petrels that could be identified on both crossings (see Table 2). The North Atlantic petrels are confusing and difficult to distinguish. Several authors (Murphy, 1936:735, 1915:171; Wynne-Edwards, 1935:279; Peterson, 1947:9; Hollom, 1953:16) agree that the flight of *Oceanodroma* alone is sufficient to distinguish it from *Oceanites* and *Hydrobates*. Another author (Rankin and Duffey, 1948:8) states that ". . . the forked tail is difficult to see and therefore should not be relied on for identification." I had very little chance to compare the flight of the petrels of these three genera. In addition to this I found on August 18 several petrels that definitely had forked tails characteristic of *Oceanodroma* but were flying much less erratically than most of the birds of this genus that I observed. For these two reasons, I excluded flight as a positive identification factor of the petrels seen on both voyages, and used only the shape of the tail. In Table 2 I included under *O. leucorhoa* all petrels definitely seen to have forked tails, although it is highly probable that the majority of the unidentified individuals seen on the westbound voyage were also of this species.

The petrels seen on July 14 at 44°N. 29°–30°W. on the eastbound trip might well have been Harcourt's Petrels (*O. castro*) rather than *O. leucorhoa*, as these species are indistinguishable in the field. The position of these petrels indicates that they could very well have been *O. castro*. Wynne-Edwards (1935:282) states that *O. leucorhoa* ranges from 300 to 500 miles off shore. Murphy (1936:736) and Rankin and Duffey (1948:8) also noticed that this species rarely ranges father than 500 miles from the American coast, and none observed any in the eastern Atlantic as far north as Ireland. The 15 petrels I observed were exactly in the middle of the ocean, 950 nautical miles from St. John's, Newfoundland, and 910 nautical miles from the nearest point of the European coast, but only slightly over 310 nautical miles from the breeding grounds of *O. castro* in the Azores. In addition, two completely unidentifiable petrels were seen farther than 500 miles from the American continent—one on July 13 at 41°N. 41°W. on the eastbound trip and the other on August

16 at 48½°N. 30° W. on the return crossing. The petrels shown in Table 2, seen on August 17 and 18, were all within 500 miles of land.

Storm Petrel (*Hydrobates pelagicus*).—One of these petrels was identified on August 15 on the westbound crossing approximately 190 nautical miles west of the Scilly Isles. Its flight was fairly straight with fast wing-beats, apparently distinguishable from that of *Oceanodroma*.

Wilson's Petrel (*Oceanites oceanicus*).—The only individual of this species identified on either trip was observed on August 18 at 41°N. 67°W. The characteristic feet that project beyond the end of the tail were seen at close range. It is interesting that I saw only once on both voyages a petrel so common in the North Atlantic. Mayr (1938:57) had a similar experience in 1938.

Gannet (*Morus bassanus*).—Only one bird of this species was observed a great distance from land. This was a juvenile seen about 150 nautical miles south of this species' breeding colonies in southwestern Ireland on July 15, 1957. *M. bassanus* became more common in the English Channel nearer to land.

?Phalarope.—An unidentified bird was seen on July 12 at 40½°N. 60°W., 420 nautical miles from New York. The general color of the upper surface was brown, streaked with a lighter color. The bird did not have a white rump-patch which is characteristic of the petrels. Migration dates do not support the possibility of this bird actually being a phalarope. August 14 is the earliest date given by Urner and Storer (1949:186) for the Northern Phalarope (*Lobipes lobatus*) on the New Jersey coast. Griscom (1939:185) found this species in Massachusetts on July 24, 1938—an early record. The migration of the Red Phalarope (*Phalaropus fulicarius*) is even later than that of *Lobipes*. Griscom (*ibid.*) showed that the main fall flight of *Phalaropus* is most likely far offshore sometime between late September and late October.

Long-tailed Jaeger (*Stercorarius longicaudus*).—Of the 11 jaegers I observed on the westbound voyage I was able to identify three as this species on August 16 at 48°–47°N. 26°–23°W. The first of these, seen flying close to the ship, was missing its projecting tail feathers and was identified by the restriction of white in the primaries to only the outer few feathers, the clear white breast, and the slenderness of the body. The other two jaegers of this species had their tail feathers intact. My observations agree with Wynne-Edwards' (1935:310) report that this species begins autumn migration in the last week of July, reaching a peak in the second half of August. Seven of the jaegers seen on the westbound crossing were too far from the ship to be identified. All of these were seen on August 16, except one that was observed the day after at 43°N. 50° W. The majority of the jaegers were found in the vicinity of Arctic Terns (*Sterna paradisaea*). Twenty-five terns were seen on August 16 when all but one of the jaegers were observed. However, jaegers were not found near all of the terns, and also four jaegers seen in the afternoon were found three to 22 nautical miles from the nearest terns. On the 17th, when only one jaeger was observed, no terns were seen all day.

?Parasitic Jaeger (*Stercorarius ?parasiticus*).—On August 16 at 48°N. 29½°W. a jaeger was observed with extensive white patches in the primaries and a prominent breast band. No projecting tail feathers could be seen to determine whether it was the Pomarine Jaeger (*S. pomarinus*) or *S. parasiticus*. However, considering the migration dates of these two species, the latter seems more probable. Wynne-Edwards (1935:304–305) observed that the migration of *S. parasiticus* begins in the last week of July, although the peak of migration does not come until the first week of September. *S. pomarinus* does not start south from its breeding grounds until the middle of August (Wynne-Edwards, 1935: 300).

Kittiwake (*Rissa tridactyla*).—I identified one adult of this species approximately 32 nautical miles west of the Scilly Isles on August 15, 1958.

Arctic Tern (*Sterna paradisaea*).—Twenty-five terns were seen on the westbound crossing in the middle of the Atlantic from 49°N. 24°W. to 48°N. 30½°W. on August 16. The color of their bills, necessary for their identification, was extremely hard to observe from the ship. The entirely red bills characteristic of *S. paradisaea* were eventually seen on three of the terns at close range. The majority of the terns seen were adults. However, there were a few in juvenile plumage with white foreheads, brown areas in their wings, and large amounts of black on their bills. The flight of these terns was not strong enough to enable them to keep up with the ship. August 16 is well within the migration dates given by Wynne-Edwards (1935:327), who states that autumn migration starts before the end of July, and Rankin and Duffey (1948:26), who, although they observed only two terns in July in mid-ocean, found that "the migratory movements continued in small numbers throughout August across the breadth of the ocean." Mayr (1938:54) observed five *S. paradisaea* in the eastern Atlantic on July 31.

Two unidentified terns were seen south of Long Island on July 11, 1957.

Summary

On two recent Atlantic crossings on passenger liners, 450 individuals of 12 species of birds were observed out of sight of land. *Puffinus gravis* was the most numerous representative of the shearwaters and *Oceanodroma leucorhoa* of the petrels. The oceanic range of *Puffinus lherminieri* extended as far north as 41°N. 60°W. during August, 1958. In 1957, *Puffinus diomedea* was observed off the American coast by July 11. In general, my observations confirm those of previous authors.

Literature Cited

Alexander, W. B.
1955 Birds of the ocean. Putnam, Boston.

Baird, J. and R. Emery
1957 *Audubon Field Notes*, 11:388.

Gordon, M. S.
1955 Summer ecology of oceanic birds off southern New England. *Auk*, 72:138–147.

Grayce, R. L.
1950 Bird transects on the North Atlantic. *Wilson Bull.*, 62:32–35.

Griscom, L.
1939 Migration of the Red Phalarope off Massachusetts. *Auk*, 56:185.

Hollom, P. A. D.
1953 The popular handbook of British birds. H. F. and G. Witherby, London.

Lockley, R. M.
1947 Shearwaters. Devin-Adair, New York.

Mayr, E.
1938 Birds on an Atlantic crossing. *Proc. Linn. Soc. N.Y.*, 49:54–58.

Murphy, R. C.
1915 The Atlantic range of Leach's Petrel (*Oceanodroma leucorhoa* (Vieillot)). *Auk*, 32:170–173.
1936 Oceanic birds of South America. Macmillan Co. and Amer. Mus. Nat. Hist., New York.

NICHOLS, C. K.
1957 *Audubon Field Notes*, 11:390.
NICHOLS, J. T.
1913 Notes on offshore birds. *Auk*, 30:505–511.
NICHOLSON, E. M.
1952 Shearwaters in the English Channel. *Brit. Birds*, 45:41–55.
PETERSON, R. T.
1947 A field guide to birds. Houghton Mifflin, Boston.
RANKIN, M. N. AND E. A. G. DUFFEY
1948 A study of the bird life of the North Atlantic. *Brit. Birds*, 41:suppl. 1–42.
URNER, C. A. AND R. W. STORER
1949 The distribution and abundance of shorebirds on the north and central New Jersey coast, 1928–1938. *Auk*, 66:177–194.
WYNNE-EDWARDS, V. C.
1935 On the habits and distribution of birds on the North Atlantic. *Proc. Boston Nat. Hist. Soc.*, 40:233–346.

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CHANGES IN THE BREEDING BIRDS OF BIRD HAVEN SANCTUARY OVER A PERIOD OF FORTY-FIVE YEARS

BY PERNA M. STINE

Bird Haven, the Robert Ridgway Memorial Bird Sanctuary and Arboretum, just north of Olney, Richland County, Illinois, had its beginning in October, 1906, only three years after the Federal Government established its first sanctuary. Robert Ridgway, then Curator of Birds at the United States National Museum, bought eight acres of young timber as a country home, a bird sanctuary, and an arboretum.

Interested in birds from his early childhood, Ridgway had begun, at the age of 13, to keep records of the birds of his home, Mt. Carmel, Illinois. In his search for the names of the birds he observed, chance brought him a great teacher, Spencer F. Baird of the Smithsonian Institution, who not only named the bird drawings Ridgway sent him, but gave help in keeping his bird records and in improving his bird pictures. With four years of bird observations completed, Robert Ridgway, through Baird's recommendation, was appointed Zoologist for the survey of the 40th Parallel in the far west. When only a boy of 17, Ridgway left for this outstanding position (April, 1867) with the resolve to return some day to live in southern Illinois.

After 40 years of waiting, Bird Haven with its wooded hills, treeless lowlands, and spring-fed stream was that dream come true. Many scientific articles and books had come from Robert Ridgway's pen in those years, his thirty-first being his observations on the birds of the Lower Wabash Valley (Ridgway, 1874). Since 1894 his work at the Museum had been the writing of "Birds of North and Middle America," a great undertaking, but one which advanced his return to southern Illinois. He could live in the country and continue his writing. With the preparatory planning and research much advanced, the first three volumes published, and the fourth (Ridgway, 1907) in progress, he bought Bird Haven. During three summers Ridgway and his wife lived there, counted the birds as they arrived, and listed the breeding birds and the unusual migrants. In 1908, the Ridgways' country home was increased to 18 acres.

During the summer of 1910 they lived in the big house on the farm adjoining Bird Haven on the north and east. Mr. Ridgway found time to search the farm for breeding birds not found on Bird Haven. The extreme heat of that summer revealed that Bird Haven was not desirable as a summer home. In October, a modern brick house on eight acres of ground was purchased in South Olney. The name, Larchmound, given by the original owner, was retained, and here the Ridgways lived the summers of 1911 and 1912, and began "year round" living in June, 1913 (Ridgway, 1915*a*).

Mr. Ridgway's plans for an endowment for Bird Haven were incomplete at the time of his sudden death on March 25, 1929. Mrs. Frances K. Hutchinson, a woman of means, a friend of conservation and of Mr. Ridgway and his work on Bird Haven, not only increased the endowment beyond Mr. Ridgway's figure but added the farm (about 100 acres) where the Ridgways had lived in 1910. This memorial to Robert Ridgway she deeded to the University of Chicago in 1932 (see Fig. 1).

I began the present study because there were breeding birds at Bird Haven that were new to me: American Woodcock, Bell's Vireo, and Cerulean Warbler. The work was planned by the late W. C. Allee, who stressed the fact that changes in the bird population could be expected due to changes in the vegetation since the publication of Ridgway's list (1914). My first observations were made in 1945 (78 hours), and annual studies were made from 1947 through 1955. For most of this period, I spent an average of 160 hours per year on the study area, but in 1954 daily trips were made during April, May, June, and most of July, for a total of 270 hours. All observations are my own except for that of Traill's Flycatcher, which was seen and heard by Robert Kirby on May 1, 1954. The House Sparrow (*Passer domesticus*) was omitted from the study.

Evidence of nesting was determined by finding an occupied nest, by seeing young being fed, or by finding a singing male throughout the breeding season. Only the Yellow-throated Vireo was listed as a nesting species on the basis of a singing male on the area. The persistent efforts of the Marsh Hawk to drive off intruders from a portion of the farm give it nesting status as far as I was concerned.

The nesting of the Whip-poor-will was in doubt until May 1, 1954, when a group of visitors flushed the adult from a nest. Jerry Chaniot from Decatur was the first to locate the nest with its two eggs. The Whip-poor-will was given regular nesting status because it was heard singing in other years. The Ruby-throated Hummingbird's nest was found when a strong wind dislodged it during August, 1954.

It gives me great pleasure to acknowledge the cooperation and valuable assistance I received from several bird students of the Olney area: Mrs. Chester Scherer, who has bird records for more than 25 years; Mrs. Vera Scherer Shaw; and Mr. and Mrs. W. R. Bridges.

After 47 years, the young trees of the 18 acres, both the native forms and those added by Mr. Ridgway, show some of the grandeur, vine-drapery, and abundant undergrowth of a virgin forest. Trees grow rapidly in southern Illinois, as shown by measurements of several fallen specimens on Bird Haven, just eight years old (Ridgway, 1918:8). A sycamore (*Platanus occidentalis*) had a diameter of 12 inches and a height of more than 40 feet; the elms (*Ulmus americana*) were only slightly smaller than this. The fallen tree is

becoming more common and here and there are "den" trees. The tree growth on the lowlands almost hides the main stream on the 18 acres as well as its many divisions on the farm. The more or less heavily wooded stretches of the farm, except for some planted areas, are the result of Nature being allowed to take over the cultivated fields and pastures of 1910 and later. The wooded stretches on either side of the north part were planted by the University. A shrubby growth covers what appears to be open spaces on the farm.

Breeding Birds 1945–1955

The 18-acre woods, with paths used for 50 years, supported 41 nesting species (Table 1). Only 39 species nested there until 1954, when the Prothonotary Warbler nested in a stump of a river birch (*Betula nigra*) along an overflow of the main stream, and the Yellow-throated Warbler made its home in a tall sycamore. Both species returned to nest the next year.

The farm, reduced to 85 acres in the early part of the study, is unlike the woods in having no paths. Fifty breeding species (Table 1) were found there, with the count in 1945 being the largest, when three of the four new breeding species were present.

The two areas attracted 31 of the same species for nesting. Ten species nested only in the woods, whereas 19 species nested only on the farm. In recent years it has seemed that some species, now confined to the woods, may in time nest on the farm. The Prothonotary and Yellow-throated Warblers, for example, were seen many times along the stream on the farm even through early June, during the last two years of the study.

There were eight breeding birds new to the area since 1910, with only the Starling present each year (1945–1955). This species was first seen in the Olney area by Mr. Ridgway in January, 1928, as reported by Brodkorb (1929).

Comparison of Breeding Birds of 1907–1910 and 1945–1955

The first report (Ridgway, 1914), for the period of 1907–1910, listed 72 breeding birds for the woods and the farm. In 1927 the Song Sparrow became the seventy-third breeding species (Ridgway, 1929*a*:1). In the period of 1945–1955, 52 of the 73 species nested in either the woods or the farm, the distribution being 37 on the 18 acres and 46 on the farm. For the early period, about 73 per cent of the breeding species were recorded for the 18 acres in the four years of observation (1907–1910), while the farm, with one year of observation (1910), had only 25 per cent of the total. It would appear that Ridgway searched the farm in order to find breeding birds not found on the 18 acres, rather than to list all breeding birds. It seems safe to assume that some of the breeding species were common to both areas then, as is true today.

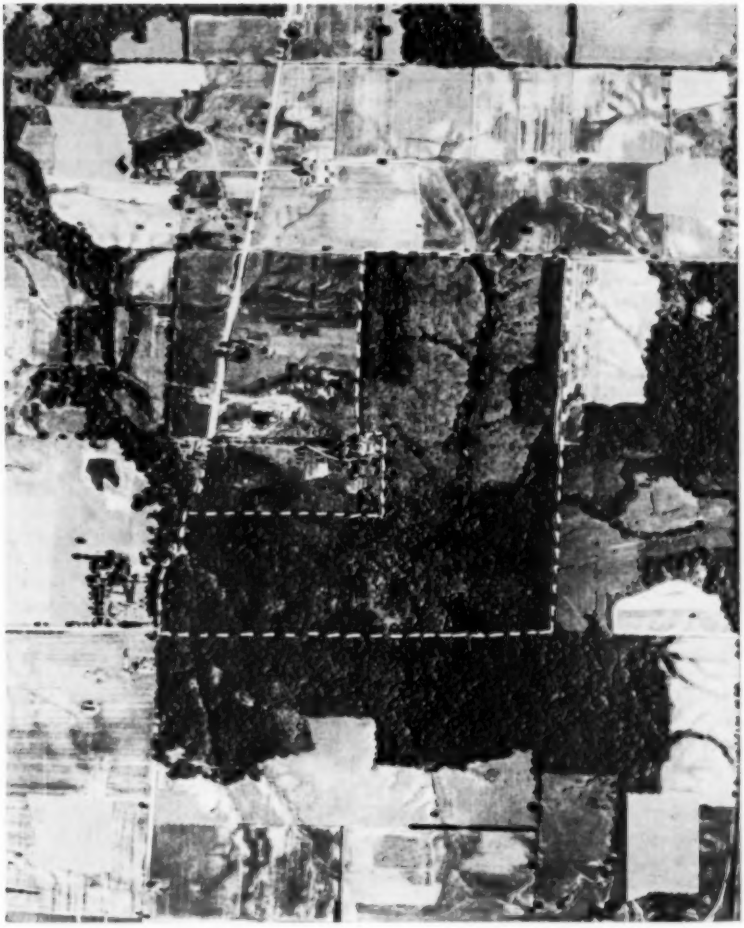

FIG. 1. Aerial photograph of Bird Haven and surroundings made by the U. S. Department of Agriculture, July 24, 1953. North is at the top. Dotted lines show approximate boundary of the sanctuary today. The 18 acres in the south portion show a dense woods with few open spaces. Note the wooded stream leaving the farm on the east.

TABLE 1

BREEDING BIRDS OF BIRD HAVEN SANCTUARY

Species	Status				No. of Years Present
	1907–1910		1945–55		
	Woods	Farm	Woods	Farm	
Green Heron (*Butorides virescens*)	B			B	9
Red-shouldered Hawk (*Buteo lineatus*)	B		B	B	10
Marsh Hawk (*Circus cyaneus*)*				B	1
Sparrow Hawk (*Falco sparverius*)	B			M	1
Bobwhite (*Colinus virginianus*)	B			B	10
Killdeer (*Charadrius vociferus*)		B	Flying over		1
American Woodcock (*Philohela minor*)		B		M	2
Spotted Sandpiper (*Actitis macularia*)		B			
Mourning Dove (*Zenaidura macroura*)	B		B	B	10
Yellow-billed Cuckoo (*Coccyzus americanus*)	B		B	B	10
Black-billed Cuckoo (*Coccyzus erythropthalmus*)	B		M	M	4
Barred Owl (*Strix varia*)	B		B		10
Whip-poor-will (*Caprimulgus vociferus*)	B		B		10
Chimney Swift (*Chaetura pelagica*)*				B	1
Ruby-throated Hummingbird (*Archilochus colubris*)		B	B	B	10
Yellow-shafted Flicker (*Colaptes auratus*)	B		B	B	10
Red-bellied Woodpecker (*Centurus carolinus*)	B		B	B	10
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	B		B	B	6
Hairy Woodpecker (*Dendrocopos villosus*)	B		B	B	10
Downy Woodpecker (*Dendrocopos pubescens*)	B		B	B	10
Eastern Kingbird (*Tyrannus tyrannus*)	B			B	10
Great Crested Flycatcher (*Myiarchus crinitus*)	B		B	B	10
Eastern Phoebe (*Sayornis phoebe*)	B		B		10
Acadian Flycatcher (*Empidonax virescens*)	B		B	B	10
Traill's Flycatcher (*Empidonax traillii*)		B		M	1
Eastern Wood Pewee (*Contopus virens*)	B		B	B	10
Purple Martin (*Progne subis*)*				B	1
Blue Jay (*Cyanocitta cristata*)	B		B	B	10
Common Crow (*Corvus brachyrhynchos*)	B		B	B	10
Carolina Chickadee (*Parus carolinensis*)	B		B	B	10
Tufted Titmouse (*Parus bicolor*)	B		B	B	10
White-breasted Nuthatch (*Sitta carolinensis*)	B		B		10
House Wren (*Troglodytes aedon*)	B		B	B	8
Bewick's Wren (*Thryomanes bewickii*)		B	B	B	5
Carolina Wren (*Thryothorus ludovicianus*)	B		B	B	10
Mockingbird (*Mimus polyglottos*)		B		B	1
Catbird (*Dumetella carolinensis*)	B		B	B	10
Brown Thrasher (*Toxostoma rufum*)	B			B	10
Robin (*Turdus migratorius*)	B		B	B	10
Wood Thrush (*Hylocichla mustelina*)		B	B	B	10

TABLE 1 (Continued)

Species	Status				No. of Years Present
	1907–1910		1945–55		
	Woods	Farm	Woods	Farm	
Eastern Bluebird (*Sialia sialis*)	B		B	B	10
Blue-gray Gnatcatcher (*Polioptila caerulea*)	B		B	B	10
Cedar Waxwing (*Bombycilla cedrorum*)		B		B	10
Starling (*Sturnus vulgaris*) *			B		10
White-eyed Vireo (*Vireo griseus*)	B			B	3
Bell's Vireo (*Vireo bellii*)		B		B	10
Yellow-throated Vireo (*Vireo flavifrons*)	B		B	B	3
Red-eyed Vireo (*Vireo olivaceus*)	B		B	B	10
Warbling Vireo (*Vireo gilvus*)		B	M	M	2
Black-and-white Warbler (*Mniotilta varia*)		B	M	M	10
Prothonotary Warbler (*Protonotaria citrea*) *			B		2
Yellow Warbler (*Dendroica petechia*)		B		B	1
Cerulean Warbler (*Dendroica cerulea*)		B	M		2
Yellow-throated Warbler (*Dendroica dominica*) *			B		2
Prairie Warbler (*Dendroica discolor*) *				B	1
Ovenbird (*Seiurus aurocapillus*) *			B		2
Louisiana Water Thrush (*Seiurus motacilla*)	B		B		3
Kentucky Warbler (*Oporornis formosus*)	B		B	B	10
Yellowthroat (*Geothlypis trichas*)	B			B	10
Yellow-breasted Chat (*Icteria virens*)	B			B	10
American Redstart (*Setophaga ruticilla*)	B		M	M	10
Eastern Meadowlark (*Sturnella magna*)	B			M	10
Redwinged Blackbird (*Agelaius phoeniceus*)	B			M	2
Orchard Oriole (*Icterus spurius*)	B			B	10
Baltimore Oriole (*Icterus galbula*)	B		M		10
Common Grackle (*Quiscalus quiscula*)		B	M	M	2
Brown-headed Cowbird (*Molothrus ater*)	B		B	B	10
Scarlet Tanager (*Piranga olivacea*)	B		M	M	10
Summer Tanager (*Piranga rubra*)	B		B	B	10
Cardinal (*Richmondena cardinalis*)	B		B	B	10
Blue Grosbeak (*Guiraca caerulea*)	B		M		2
Indigo Bunting (*Passerina cyanea*)	B		B	B	10
Dickcissel (*Spiza americana*)		B	M		1
American Goldfinch (*Spinus tristis*)		B		B	10
Rufous-sided Towhee (*Pipilo erythrophthalmus*)	B			B	10
Grasshopper Sparrow (*Ammodramus savannarum*)		B			
Lark Sparrow (*Chondestes grammacus*)		B			
Bachman's Sparrow (*Aimophila aestivalis*)	B				
Chipping Sparrow (*Spizella passerina*)	B		B		10
Field Sparrow (*Spizella pusilla*)	B			B	10
Song Sparrow (*Melospiza melodia*)	B		M	M	10

Key: Woods—the 18 acres; Farm—land added to Bird Haven in 1929; B—Breeding; M—Migrant; * species added in the 1945–1955 study.

Of the 21 species no longer nesting in either area, 17 were migrants in one or both areas in the 10 years of this study (see Table 1). Three of the remaining four were seen in the Olney area, the Spotted Sandpiper as a migrant, the Grasshopper and Lark Sparrows as breeding birds. Bachman's Sparrow, however, was not seen in any part of Richland County in the whole 10 years. This species seems to have made the most decided change of the 21 species.

There were changes in the breeding birds in both the woods and the farm in the 10 years, most of which were from unknown causes. Only the absence of the Chimney Swift, Purple Martin, and Mockingbird after the first year, seemed to have an explanation. All were associated with the home of the custodian in 1945. After this house burned and the site, some 13 acres, was sold, these species failed to find a new nesting location, even though the martin house was moved to the new home in the woods. The Prairie Warbler, found nesting on the farm in 1945, was seen only once after that (May 2, 1954).

My lack of knowledge of the song of Traill's Flycatcher may account for the limited records for this species. A report of breeding birds on Larchmound (Ridgway, J. E., 1924:38) states that this species nested only one year out of seven. Mr. Ridgway had only one record of the nesting of the Blue Grosbeak.

Changes in Bird Life

Mr. Ridgway wrote (1929*b*:177) to Frank M. Chapman that "As years go by I am more and more impressed by the marked difference in bird life in different years. This is true of both summer and winter residents." Seventy per cent of the breeding species of the 1907–1910 period did not change in the 45 years; the 30 per cent that did change are given attention here.

The 21 species no longer nesting in either the woods or the farm may be separated into two groups: (1) species nesting in the Olney area; and (2) species nesting outside the Olney area. The varying abundance of Group (1) is shown by the listing as common, uncommon, or rare elsewhere in the Olney area.

Common—each in a habitat not well represented on Bird Haven:

Sparrow Hawk	Redwinged Blackbird
Killdeer	Common Grackle
Warbling Vireo	Dickcissel
Eastern Meadowlark	Song Sparrow

Uncommon—known to nest *some* years, the last two species in habitats not found on Bird Haven:

American Woodcock	Grasshopper Sparrow
Baltimore Oriole	Lark Sparrow

Rare—known nesting limited to the dates given:

Cerulean Warbler, 1954, 1955

American Redstart, 1955

There are no recent nesting records for the following species at Bird Haven or the Olney area:

Spotted Sandpiper
Black-billed Cuckoo
Traill's Flycatcher
Black-and-white Warbler
Scarlet Tanager
Blue Grosbeak
Bachman's Sparrow

The present status of eight species that were on the decrease in 1915 (Ridgway, 1915*a*, *b*, *c*) may be summarized as follows:

Yellow Warbler: Absent; one known nesting in 45 years.

Baltimore Oriole: On the decrease until 1950, but some nesting since that time.

White-eyed Vireo: Present in most years but irregular.

Dickcissel: Common, but makes frequent changes in nesting field.

Carolina Wren, Wood Thrush, Warbling Vireo, and Yellow-breasted Chat: Abundant. The first two were reported as common by 1929 (Ridgway, 1929*a*:1).

Summary and Conclusions

This study (1945–1955) of the bird life of the 18 acres of woods and the 85 acres of farm land composing Bird Haven resulted in the recording of 60 species of breeding birds, 41 for the woods and 50 for the farm. Slightly more than half of the 60 species were found in both areas.

The woods had 10 species of breeding birds not found on the farm, whereas the latter, with a greater area and a more varied habitat, had 19 species not found in the woods.

A comparison with the list of the birds found breeding here by Ridgway in the period 1907–1910 showed 52 species still nesting in either the woods or the farm, more than half being found in both regions. Twenty-one species of the earlier report no longer nested in either; 17 of these were recorded as migrants in this study, and 14 were known to nest in the Olney area, many in habitats not well represented in either the woods or the farm. Seven species, or one-third of the 21, for which there were no nesting records for the Olney area in 10 years, were thought to have changed their nesting for unknown causes.

The bird life of the study area changed over the 10-year period in this study, as well as over the relatively long period (40 years) between the two studies. These changes were apparently due to changes in habitats. Some species on

the decrease in 1915 were common to abundant for the whole period of the present study, while others were absent. One, the Baltimore Oriole, on the decrease for more than 50 years, returned to nest in small numbers in the Olney area since 1950, while the Yellow Warbler, scarce in 1915, has not reappeared. Only one (Starling) of the eight new breeding species of this study was present each year.

Literature Cited

Brodkorb, P.
1929 Summer notes from southern Illinois. *Auk*, 46:398.

Ridgway, R.
1874 The lower Wabash Valley, considered in relation to the faunal districts of the eastern region of North America with a synopsis of its avian fauna. *Proc. Boston Soc. Nat. Hist.*, 16:1–31.
1907 Birds of North and Middle America. *U.S. Nat. Museum*, no. 50. Part IV:1–973.
1914 Bird-Life in southern Illinois. I. Bird Haven. *Bird-Lore*, 16:409–420.
1915*a* Bird-Life in southern Illinois. II. Larchmound: A Naturalist's Diary. *Bird-Lore*, 17:1–7.
1915*b* Bird-Life in southern Illinois. III. Larchmound: A Naturalist's Diary. *Bird-Lore*, 17:91–103.
1915*c* Bird-Life in southern Illinois. IV. Changes which have taken place in "Half a Century." *Bird-Lore*, 17:191–198.
1918 The need for forests and game preserves in southern Illinois. *Aud. Bull.* Winter, 1918–19:5–11.
1929*a* Bird Haven—its purpose and present status. *Bird-Lore*, 31:1–6.
1929*b* Letter to Frank M. Chapman. *Bird-Lore*, 31:173–178.

Ridgway, J. E.
1924 Larchmound. Arbor and Bird Day, *Illinois Circular*, no. 183:34–38.

1304 Tenth Avenue, Zephyrhills, Florida, March 13, 1959

GENERAL NOTES

Pileated Woodpecker attacks pilot black snake at tree cavity.—Although the Pileated Woodpecker (*Dryocopus pileatus*) and the pilot black snake (*Elaphe obsoleta*) occur together in the woodland habitat of much of the eastern United States, an incident in which this snake climbed a tree to eat nestling Pileated Woodpeckers was considered "remarkable" by Hoyt in her report on the latter species (1957. *Ecology*, 38:246–256). On the occasion mentioned, the observer rescued the young birds and thus lost the chance of witnessing the response of the adult woodpeckers to the predator. Information about such a response is desirable because the woodpecker may encounter this common arboreal, bird-eating snake more frequently than the reported evidence would indicate, and because, in general, very little is known about predation in the ecology of the Pileated Woodpecker (Hoyt, *op. cit.*, 255; Bent. 1939. *U.S. Nat. Mus. Bull.*, 174:164–194). Kilham (1959. *Wilson Bull.*, 71:191) has recently reported observing a black snake that spent five days in a cavity a few feet from a Pileated nest and left without taking the nestlings. The present note describes an apparently fatal attack by a male Pileated Woodpecker on a large black snake which had entered a hollow used by a pair of the birds near Bloomington, Indiana.

The nest at which the incident occurred was 20 feet up in a dead beech (*Fagus grandifolia*) stub 26 feet high, 22 inches dbh, and about 17 inches thick at the level of the entrance to the cavity. The hole in the tree faced west and measured some three inches wide by three and one-half inches high.

About a week prior to May 23, 1958, a male Pileated Woodpecker had been discovered entering the tree, and a day or two later a female went in. Each of the pair was seen going in several more times; and this fact, the date, and the behavior herein reported are the basis for the assumption that there probably was a nest there. The birds did not relieve each other at the cavity, which suggests the possibilities that it contained either an incomplete clutch of eggs or held young being brooded only part of the time. If there were young, however, they were not yet old enough to greet returning parents at the entrance to the nest. Since adults feed nestlings by regurgitation, food-bringing would not have been noticed.

From the hole at 2 p.m. on May 23, there protruded part of a pilot black snake; the posterior two feet or so were visible, and the girth of this segment indicated a total length of a little over five feet. In the next 15 minutes a few more inches of the body moved slowly out of sight. Finally the snake disappeared into the hollow, and shortly thereafter the male woodpecker arrived at the tree, hopped up, looked in, and withdrew his head. To me, 30 yards away and (because the nest stub was on a hill) at eye level, no sound was audible, nor was there any display or other response suggesting alarm or excitement. Instead, the woodpecker began deliberately and methodically to deliver hard blows into the cavity, pausing for from 10 to 60 seconds after each one or two jabs; during these pauses the bird remained in position and looked into the hole or, more rarely, surveyed the surrounding woods. Occasionally the snake could be glimpsed dimly as part of its body passed before the aperture. In the course of 20 minutes, in which some 50 or 60 blows were delivered, the orientation of the woodpecker's attack shifted from the bottom of the hole to a point above the entrance and then back down again. It therefore seemed possible that the blows were aimed at a specific part of the snake, perhaps the head. One or two quick movements by the bird may have been reactions to strikes by the snake; otherwise there was nothing to suggest effective resistance.

About 20 minutes after the male's appearance the female flew to a nearby tree and then landed beside her mate. The male thereupon departed, not to return during the remainder

of the observation. To the last, his behavior seemed free of excitement, and it was soon indicated that probably he had communicated no alarm to the female: she hopped quickly to the entrance and thrust her head well in, then jerked backward so suddenly and violently that she lost her grip and fell away from the tree. Returning immediately, she began constantly to thrust her head in and out of the hole and continued to do so for at least half an hour, at first as often as 30 times a minute. Evidently there was little life remaining in the snake, for gradually the bird left her head in the cavity for longer stretches, finally for 10 seconds at a time. However, even after 30 minutes, when it was necessary to discontinue observation, she was still alternately scrutinizing the contents of the hole and then looking at the woods around her, as though in considerable nervousness. (Probably neither woodpecker ever was aware of my presence.)

Repeated visits to the tree during the days that followed disclosed no Pileated Woodpeckers near it; the nest, if there was one, apparently failed when the snake gained entrance to it. No informative traces could be found on the surrounding ground, but dense vegetation may have hidden the snake's body, even if the woodpeckers removed it and dropped it nearby.

Throughout incubation and early life of nestlings, one member of the pair of Pileated Woodpeckers is virtually always at the nest (Hoyt, *op. cit.*, 251–253), and this was true of the birds observed by Kilham (*op. cit.*). If the behavior described herein is typical and the reaction to a snake entering or attempting to enter the nest is to attack and sometimes overcome it, then nest relief must greatly reduce the risks from this group of predators. In the light of the present observations, it is the more interesting that Kilham should have seen a five-foot black snake making its departure after five days spent harmlessly so near a cavity containing small young.—Val Nolan, Jr., *Indiana University, Bloomington, Indiana, August 12, 1959.*

A North American sight record of the Redwing.—On February 21, 1959, at ca. 10:00 a.m., Messrs. S. Stepinoff, S. Ozard, T. Peszel, J. Kirk, and I discovered a Redwing, *Turdus musicus* (*Turdus iliacus* of some authorities), at the West Impoundment of the Jamaica Bay Wildlife Sanctuary, Ruler's Bar Hassock, Queens County, New York. The Redwing is a Palaearctic thrush not previously reported on the North American mainland, though recorded several times in Greenland (1957. A.O.U. Check-list, 5th ed., p. 430). The bird was observed at distances varying from 20 to 100 feet by means of 10×50 binoculars and a $20\times$ spotting telescope. The individual was extremely wary, repeatedly taking flight when efforts at closer approach were made; such molestations having been ceased however, the Redwing was observed to feed on the berries of several shrubs in the area of the sanctuary parking-field. Upon his arrival, Mr. H. Johnson, manager of the sanctuary, was shown the bird. Johnson recalled having seen it in the locality on the previous day, though he had not identified it. During the next two days a large number of observers gathered at the sanctuary, including several familiar with the species in Britain and Europe. The Redwing was last seen on February 24, 1959.

By way of description, I observed the following features on February 21:

Head, wings, back and tail were of a neutral brown-gray color, somewhat broken with light gray on the secondaries and coverts. The face-pattern, consisting of striking white moustachial and superciliary stripes, was unusually bright. The underparts were white, with black streaking on the breast, the flanks and wing-linings possessing the reddish coloration characteristic of the species. The bill was yellow with a black tip, or perhaps a black tip to the upper mandible alone.

Inquiry has failed to locate any cage-bird dealer or zoological collection in the city

dealing in or possessing individuals of this species. Unfortunately, the number of aviculturalists and zoological supply houses in the neighborhood of the metropolis is legion. It is well to note however, that the behavior of the Redwing seemed characteristic of a wild bird, rather than of one accustomed to the proximity of humans.—CHARLES F. J. YOUNG, *Photographic Service Division, New York Public Library, New York 18, N.Y., April 23, 1959.*

Notes on pairing and nest-building of mismatched vireos.—A study on species relationships in the genus *Vireo* (Hamilton, 1958. *Wilson Bull.*, 70:307–346) analyzes the relationship between the Solitary and Yellow-throated Vireos (*V. solitarius* and *V. flavifrons*). The following notes may be of value to the study of interspecific relationships of these species.

On May 19, 1958, a Yellow-throated Vireo, with something in its bill, flew into a tall post oak in my front yard. The following day I located its nest in the oak on a slender branch which made a downward arc from a larger branch, 25 feet from the ground and 12 feet out from the trunk of the tree.

A vireo was present, working in the nest. This bird had no yellow at the throat or eyes, although wing-bars and a light eye-ring were evident. Careful study of the bird on succeeding visits, and reference to the discussion of vireo plumages in Bent (1950. *U.S. Nat. Mus. Bull.*, 197) and Dwight (1900. *Ann. New York Acad. Sci.*, 13:239), confirmed an early speculation that this bird, a female, was a Solitary Vireo, perhaps of the subspecies known as the Mountain Vireo (*Vireo solitarius alticola*). [Southern Pines, 20 miles west of Fayetteville, is the easternmost known nesting area of the Solitary Vireo in this state (1948. *The Chat*, 12:53).] The bird had a dark head and back, white eye-ring and wing-bars, complete absence of yellow at the throat, but a strong yellow wash at the sides. The throat, breast, and belly were white. On one visit, during a light drizzle, the back appeared slaty-brown. In addition, there was a creamy yellow wash at the crissum (which Dwight stated was limited to juvenal plumage).

The Yellow-throated Vireo, the male of this pair, was in song and present at the nest area most of the time although it was never seen working in or about the nest. Bent (*op. cit.*) records that both sexes of *flavifrons* are assiduous and attentive nest-builders; that the female of *solitarius* "seems to do most of it and to be the dominant influence, the male's part consisting mainly of bringing materials."

The male Yellow-throated Vireo accompanied the female Solitary Vireo on her visits to the nest, perching nearby while she worked at the interior and the rim. Both birds were seen on a number of occasions perched side by side in pine trees in the yard, preening or resting. On May 26 the female Solitary Vireo made nine recorded visits to the nest, the exterior of which appeared complete; the male Yellow-throated Vireo sang more incessantly than on previous days. Twice on this day, I saw the male Yellow-throated Vireo join the female at the nest site. The male displayed, with wings fluttering; the pair copulated briefly only a few inches from the nest. On both of these occasions, the female remained crouched in a begging posture, with wings fluttering, after the male had hopped to a nearby perch.

On May 27, at 7:05 a.m., I saw a Yellow-throated Vireo fly silently to the nest. The bird got in, shaping and arranging the interior and the rim. Since I had never seen the male Yellow-throated Vireo in the nest, I watched carefully after the bird left; at 7:45 a.m. *two* Yellow-throated Vireos flew to the nest site, one perching silently nearby while the other got into the nest to turn and work in it briefly before they both left.

There was no way to determine whether this was an intruding pair of Yellow-throated

Vireos, or whether the male of the original mismatched pair was attracted to a female of his own kind. At 8:05 a.m. the female Solitary Vireo visited the nest alone and worked in it briefly. A Yellow-throated Vireo was perched near the nest, and singing, when the Solitary Vireo returned at 9:10 a.m. and remained to work in the nest for two minutes. The female Solitary Vireo then flew to a neighboring oak to preen in the sun. She stayed within 50 feet of the nest for the following 50 minutes, something I had not seen her do before; she was not joined by her mate. The female Solitary Vireo made a final brief visit to the nest at 10:06 a.m., remaining only a few seconds before flying off for the last time. A Yellow-throated Vireo, perched near the nest, sang as she approached as well as during and after her last visit. The Yellow-throated Vireo did not fly toward, nor threaten, the Solitary Vireo, unless its song, during her visit to her nest, constituted a threat.

Later that morning, I saw a Yellow-throated Vireo at the nest on three separate occasions. Each time the bird got into the nest to turn and shape it; each time it seemed to peck and eat something from the rim; and on each visit the bird sang. Although I did not see two Yellow-throated Vireos in the area at the same time again until several days later, a Yellow-throated Vireo was present and singing through much of the afternoon. A single Yellow-throated Vireo was seen at the nest early the following morning. No other vireos were heard or seen in the area until May 30, when a pair of Yellow-throated Vireos hopped through the branches of a pine tree and then flew toward, but over, the nest tree and out of sight.

A week later I secured the empty nest and sent it to Dr. Herbert G. Deignan at the U.S. National Museum. After comparing the nest with those of a series of Yellow-throated, Solitary, and Mountain Vireos, in company with Dr. Alexander Wetmore, Dr. Deignan wrote:

". . . Your nest distinctly fits with the nests of the two blue-headed races in its greater dimensions, and does not disagree with them in materials. This would seem to show that, while both members of a mated pair of vireos take part in nest-building, it is the female that is responsible for the architecture of the nest. . . ."—Doris C. Hauser, *309 Sylvan Road, Fayetteville, N. C., January 1, 1959.*

Sparrow Hawks attempting to breed in the laboratory.—Sibling Sparrow Hawks (*Falco sparverius*) taken before they could fly, were kept in a cage (6 × 2 × 5 feet high) in the laboratory (temperature 19° to 21°C.—winter; 23° to 28°C.—summer). They were fed white rats and mice, horse meat and wild birds.

In March, nearly a year after hatching, a pasteboard box with a hole 5 × 6 inches in the side was fastened in the upper corner of the cage. The birds soon enlarged the hole. On April 30 an egg was laid but disappeared the next morning. Five days later a second egg was found but was broken a few hours later. A third egg, laid seven days after the first, remained for 19 days when it was broken. No more eggs were laid.

In late February of the following year the female became very active trying to push the male along the perch and pecking him without response. A few days later (March 8) copulation started. During the height of their sexual activity copulation was frequent. For example, on March 15 they copulated 14 times from 7 a.m. to 7:36 a.m.; six times more before noon and once more at 4:50 p.m. The female was the aggressor. As the season advanced sexual activity diminished, so that by early May copulation occurred only once or twice a day and then ceased. Four eggs were laid but all were broken soon afterwards.

The female died at 30 months of age, having eaten a bird that may have been infected. She was replaced by another female a few months old. At first the newcomer became so aggressive that a few days' separation was necessary. Shortly after the female was returned

to the large cage the male attempted copulation but the female was not receptive until the latter part of March when copulation became frequent. On May 6 the first egg was laid but soon was broken. By the time a sixth egg (May 25) had been laid the female was setting much of the time, the male replacing her occasionally. None of the eggs hatched.

Each year the birds began to show an interest in the nest box during the last days of February and did a little courting. Laying began about the middle of April and continued into May until five or six eggs had been laid. In one season, of three eggs which remained unbroken, one was not fertile but the other two contained embryos. None ever hatched.

At 86 months of age the male died of encephalitis. The remaining female survived five years more, dying at the age of 115 months. A year before this she began to refuse all food but white mice, although she appeared in good condition. A week before death, her appetite began to fail and she would sit on her perch with eyes closed. An autopsy was performed but no pathology was found.—FRANK A. HARTMAN, *Department of Physiology, The Ohio State University, Columbus, Ohio, December 15, 1958.*

Chipping Sparrow copulates with House Sparrow.—On the afternoon of July 17, 1959, an adult male House Sparrow (*Passer domesticus*) was feeding approximately 15 feet from a small Scotch pine in Kalamazoo, Michigan. This tree contained a nest of a pair of Chipping Sparrows (*Spizella passerina*), in which was one young bird. One of the Chipping Sparrows, a male judging from its bright rufous crown, flew from the tree and alighted, facing the House Sparrow and some two feet from it. The House Sparrow, with partially extended wings and upturned bill, immediately hopped toward the Chipping Sparrow in the attitude usually associated with food-begging by young House Sparrows. The Chipping Sparrow retreated approximately one foot from the advancing House Sparrow, then turned and advanced toward it. While the House Sparrow was still crouched with partially extended wings, the Chipping Sparrow hopped to its side, mounted the now passive bird and attempted copulation. I could not ascertain if actual cloacal contact was achieved. No longer than four seconds passed from the time the Chipping Sparrow mounted until it fluttered off and returned to the nest tree. The House Sparrow, after approximately 30 seconds, flew to a nearby building.—THANE S. ROBINSON, *Department of Biology, Western Michigan University, Kalamazoo, Michigan, August 7, 1959.*

Caspian Tern and Black Skimmer in Newfoundland.—On July 10, 1958, Tordoff and an ornithology class from the University of Michigan Biological Station found a single pair of Caspian Terns (*Hydroprogne caspia*) nesting in a large colony of Ring-billed Gulls (*Larus delawarensis*) at Rogers City, Presque Isle County, Michigan. These terns very likely were the same individuals found nesting there in 1957 (Pettingill, 1958. *Jack-Pine Warbler*, 183–184). With the adult terns we found two large young capable of short flights. We captured and banded (FWS 566-32953) one of the young.

On September 30, 1958, this tern was shot by Mr. Edwin Keeping at Boxey, Fortune Bay, Newfoundland. Southern wrote to Keeping to confirm the information received from the U. S. Fish and Wildlife Service Bird Banding Office. The recovery date sent to us by this office was October 9, which seems to be the date the report was received rather than the date the bird was taken. In addition to supplying details on the tern, Mr. Keeping also sent to us for identification part of another bird—the bill and anterior part of the crown and face of a Black Skimmer (*Rynchops nigra*), probably a male judging by bill size. Keeping had taken the skimmer at Boxey on September 30, 1958. The specimen has been sent to the National Museum of Canada for permanent preservation.

The Caspian Tern is an "uncommon summer resident" in Newfoundland and probably

breeds in the Fortune Bay area (Peters and Burleigh, 1951. "The Birds of Newfoundland"), but the northeastward journey of our banded bird is noteworthy. It is possible, of course, that the tern was carried to Newfoundland from some coastal point to the south by 1958's hurricane Helene. The Black Skimmer, judging by records available for the Fifth Edition (1957) of the A.O.U. Check-list, has not been reported previously from this province. However, W. Earl Godfrey informs us that over two dozen Black Skimmers were seen alive or found dead in Newfoundland in late September and early October, 1958, displaced victims of the same hurricane Helene.—Harrison B. Tordoff and William E. Southern, *The University of Michigan Museum of Zoology, Ann Arbor, Michigan, August 20, 1959.*

Notes on a late nesting of Harris' Hawks near Midland, Texas.—The A. O. U. "Check-list of North American Birds," (5th ed.) 1957, gives the following southern resident ranges for the two subspecies of Harris' Hawk (*Parabuteo unicinctus*): (1) *P. u. harrisi*: from southern Texas (Eagle Pass, San Antonio, Giddings) south into Mexico, etc. (2) *P. u. superior*: from southeastern California, Arizona, and southern New Mexico (Carlsbad) south to Baja California, Sonora and Sinaloa. Neither of these ranges includes Midland, Texas, which is on the southern edge of the Llano Estacado, approximately 300 miles north and west of Eagle Pass and 200 miles east of Carlsbad.

Since the winter of 1956–1957, Harris' Hawks have been observed continuously on the Clarence Scharbauer "South Curtis" ranch, three miles north of the city limits of Midland. No observations were made on the ranch prior to that winter and no nest that could be attributed to that species was found prior to 1958.

On October 1, 1958, an adult Harris' Hawk was flushed from a nest in a soapberry (*Sapindus saponaria*) grove at a water tank supplied by windmill, 2.2 miles north of the ranch house. The down-covered head of one young was seen at the edge of the nest. A young bird had been heard calling from the nest on September 23 and 26, but on neither day was an adult bird seen. On October 6, the young hawk was able to stand in the nest and, from a continuous up and down movement of the head, was either preening itself or feeding on something in the nest. On October 8, there were two down-covered young in the nest. On that date, and again on October 9, we flushed the adult from the nest at a distance of about ¾ mile.

The nest was approximately 15 to 18 feet above ground near the top of a soapberry tree, placed in the bend of one upright limb, and supported by another limb. The tree was 10 inches DBH. The nest was about two to two and one-half feet in diameter, and made on the outside of thick twigs and branches from soapberry, mesquite (*Prosopis juliflora*) and hackberry (*Celtis laevigata*), all of which were readily accessible to the nest site. The only food items seen near the nest were rabbits, including one full-grown rabbit and assorted parts.

From October 10 to 19, the road to the nest was impassable because of mud. On the 19th, the adult flushed at ¾ mile. Both young were well down in the nest with only their heads visible. The heads were almost feathered, though some down could be seen. On October 20, one of the young was standing on the edge of the nest. The wings seemed to be completely feathered; the head almost feathered, with some down feathers remaining; and the breast buffy with brown to black streaks. Both young were standing on the nest on October 21, and one appeared slightly older than the other. Two adult hawks were in the grove, and three adults were elsewhere on the ranch. On the 22nd, there was a definite white band seen at the end of the tail of the older young. Before this date, the tails had not been seen. The adult hawk flushed from the nest at a distance of about 100 yards on October 23 and flew only a short way into the grove.

The first young left the nest either late on October 23 or early October 24. On the 24th, it was found in a tree about 20 yards from the nest and alternately flew and hopped until it had returned to the tree nearest the nest tree.

Rain again made the road impassable from October 24 to November 6, but we walked to the grove from the nearest paved road on October 30. There were two adults soaring near the grove and one bird on the nest. Whether it was an adult or an immature could not be determined, since it was well down in the nest with only its back visible. On November 6, three Harris' Hawks were flushed from the windmill about 200 yards from the nest. Two were mature, but the third disappeared into the grove before it could be seen well. One young hawk was standing on the side of the nest. It made no effort to fly, and its craw seemed to be full—as it was on every occasion when the breasts of the young hawks could be seen, though trips to the nest were made at various times of day between 9 a.m. and 3 p.m.

On November 10, two adult hawks and one immature were in the east side of the grove about 300 yards from the nest. The other young hawk was standing on the edge of the nest. Its wings, head and tail appeared fully feathered; its breast was still very streaked. It left the nest either late on November 10 or early on November 11, and both young hawks were found in the grove on November 11. One called from a tree about 50 yards from the nest and then flew reasonably well. The tail and upper sides of the wings had an adult appearance. The breast was still quite streaked and the undersides of the wings were lighter in color than the adult underwing, with less differentiation between the color of the flight feathers and that of the wing linings.

Both immatures were still in the grove on November 13, but were not found again until December 21, when they and two adults were at a tank .7 mile from the grove. On December 31, two adults and two immatures were seen in the grove, and a group of four was seen on January 7, 1959, about three miles from the grove.

Bent (1937. *U. S. Nat. Mus. Bull.* no. 167) gives the latest egg dates for Harris' Hawks as June 21 (p. 147). The incubation period is "said to be 4 weeks" (p. 143), but no reference is made to any known nest. If that incubation period is correct, these eggs must have been laid on or about August 25, two months later than any eggs noted in Bent. No reference to later egg dates has been located elsewhere, and correspondence with several residents of south Texas has produced no later dates.—ANNE L. LESASSIER, *1611 W. Indiana, Midland, Texas,* and FRANCES C. WILLIAMS, *c/o City Carrier 102, Midland, Texas, January 27, 1959.*

Laughing Gulls following the plow.—It has long been known that several members of the genus *Larus* throughout the world habitually feed in soil turned up by a plow. This practice has been associated with such insect-eating gulls as Franklin's Gull (*L. pipixcan*), Ring-billed Gull (*L. delawarensis*), California Gull (*L. californicus*), Black-headed Gull (*L. ridibundus*), Lesser Black-backed Gull (*L. fuscus*), Mew Gull (*L. canus*), and others. (See, e.g., Bent, 1921, "Life Histories of North American Gulls and Terns," Washington; and Witherby, *et al.*, 1944, "The Handbook of British Birds," Volume V, London.)

To my knowledge, this has never been recorded for the Laughing Gull (*L. atricilla*), except for a brief reference to Laughing Gulls ". . . seen . . . scattered over . . . newly-ploughed fields, regaling on . . . worms, insects, and their larvae . . ." by Wilson (Brewer, 1854. "Wilson's American Ornithology." New York). However, no reference was made here to the act of following the plow in operation.

At various times between April and July of 1955 and 1956, I frequently observed Laughing Gulls following plows on the eastern shore of Maryland and Virginia. These were

noted most often in the Sinepuxent area south of Ocean City, Worcester County, Maryland, and near Exmore, Northampton County, Virginia.

The Laughing Gull, a common nesting bird here, is rather closely associated with the seacoast and rarely strays inland when feeding. However, in this area, where farm land often adjoins the sea, this species could easily come into contact with farm land being plowed, and with other gull species following the plow. This provides a situation where learning can take place.

This learning process is not as difficult as might be supposed, for these gulls, as well as others, commonly investigate passing boats and follow those which throw off scrap fish and other food. It would not take long for a gull to learn to follow an object, in this case a plowing tractor, especially if other gulls are already feeding behind it. According to the observations of Frings, *et al.* (1955. *Wilson Bull.*, 67:155–170), on Herring Gulls (*L. argentatus*), at least some gulls are stimulated by sight and sound to investigate a group of feeding gulls.—Robert G. Wolk, *Department of Biology, St. Lawrence University, Canton, New York, March 3, 1959.*

NEW LIFE MEMBER

Mrs. Chandler Robbins II, a busy housewife at Eastern Point, Gloucester, Massachusetts, finds time to pursue her natural history interests in several ways. She is a volunteer associate of the Natural History Department of the Peabody Museum, and participates in the banding of pelagic birds off the coast of Cape Ann, Massachusetts.

Since her graduation from Bryn Mawr College, Mrs. Robbins has written several articles for *Massachusetts Audubon*, has been elected a director of that society, and has become a member of the A. O. U.—all in addition to raising five teen-age children.

ORNITHOLOGICAL NEWS

We are pleased to announce that Dr. R. M. Strong, a Founder and Past President of the Wilson Ornithological Society, has been named our fourth Patron through the gift of an anonymous donor.

It is indeed a pleasure for me, especially as a neophyte editor, to take this opportunity to express my sincere appreciation to members of the editorial board—George A. Bartholomew, Andrew J. Berger, William W. H. Gunn, William A. Lunk, Robert A. Norris, Kenneth C. Parkes, Raymond A. Paynter, Jr.—and to H. Albert Hochbaum and O. S. Pettingill, Jr., for their excellent cooperation in critically, seriously, and promptly reviewing material intended for publication in the *Bulletin*.—H.L.B.

FROM THE A. O. U.

Notice has been received of the following results of elections at the August meeting (77th stated) of the A. O. U. at Regina, Saskatchewan: President, George H. Lowery, Jr.; First Vice-President, Dean Amadon; Second Vice-President, Austin L. Rand; Treasurer, Charles G. Sibley; Secretary, Herbert G. Deignan; Class of Fellows—John Davis, Thomas R. Howell, A. Starker Leopold; Class of Elective Members—H. Lewis Batts, Jr., Pershing B. Hofslund, C. Stuart Houston, Richard F. Johnston, Martin H. Moynihan, Robert K. Selander; Corresponding Fellows—F. W. Merkel (Germany), Derek Goodwin (Great Britain), Frantiček Turček (Czechoslovakia), V. C. Wynne-Edwards (Great Britain); Editor of *The Auk*, Donald S. Farner.

The Brewster Memorial Award went to Alexander Wetmore for more than 50 years of distinguished work in avian paleontology and systematic ornithology.

The 1960 meetings will take place in Ann Arbor, Michigan, from August 23 to 26.

The Rockbridge Alum Springs Biological Laboratory will soon be open for research students or others interested in working in the several branches of the natural sciences. A number of experimental field research projects have been going on for several years during building construction, and during the packing and removal of specimens and library from Florida to Virginia.

W. O. S. members who are capably interested in entomology, forestry, horticulture, or the practical and working side of conservation, and who are desirous of a paying position may write to Harold H. Bailey, c/o the laboratory, Route 2, Goshen, Virginia, for further information.

The Division of Biological and Medical Sciences of the National Science Foundation announces that the next closing date for receipt of basic research proposals in the Life Sciences is January 15, 1960. Proposals received prior to that date will be reviewed at the the spring meetings of the Foundation's advisory panels, and disposition will be made approximately four months following the closing date. Proposals received after the January 15, 1960 closing date will be reviewed following the summer closing date of May 15, 1960. Inquiries should be addressed to the National Science Foundation, Washington 25, D. C.

JOSSELYN VAN TYNE MEMORIAL LIBRARY

The following gifts have been recently received. From:

Arthur E. Aronoff—1 reprint
H. Lewis Batts, Jr.—4 journals, 1 reprint
Donald E. Burton—1 journal
Peter S. Chrapliwy—7 reprints
W. Powell Cottrille—3 journals
Jack P. Hailman—1 reprint
Bette J. Johnston—1 book
Peter H. Klopfer—4 reprints
Harold F. Mayfield—6 journals, 27 reprints
University of Michigan Museum of Zoology—12 reprints, 2 occasional papers
Margaret M. Nice—2 journals, 26 reprints
Walter P. Nickell—1 reprint
D. F. Owen—2 journals, 6 reprints
Peabody Museum—2 journals, 1 reprint
O. S. Pettingill, Jr.—7 reprints
University of Puerto Rico—9 reprints
William B. Robertson, Jr.—6 reprints, 2 pamphlets
Rose Lake Wildlife Experimental Station—1 reprint
Aretas A. Saunders—2 books
W. E. Scott—4 reprints, 9 pamphlets
Charles G. Sibley—6 reprints
P. Stettenheim—1 journal, 1 reprint
Robert W. Storer—1 pamphlet
Syracuse University College of Forestry—37 reprints
Harrison B. Tordoff—3 reprints
Mrs. Josselyn Van Tyne—130 books, 200 reprints
Wisconsin Conservation Department—1 pamphlet
Wisconsin Society for Ornithology—15 reprints
H. E. Wolters—2 reprints

A correction: Through an unfortunate error the contribution of 66 journals to the Josselyn Van Tyne Memorial Library by Mr. John Willoughby was reported in the March, 1959, donor list as being by "George Willoughby." Our apologies, and again our appreciation, to Mr. Willoughby.

ORNITHOLOGICAL LITERATURE

FUNDAMENTALS OF ORNITHOLOGY. By Josselyn Van Tyne and Andrew J. Berger. John Wiley & Sons, Inc., New York, 1959: 6 × 9¼ in., xii + 624 pp., 252 illus. $11.75.

Josselyn Van Tyne had been disturbed for many years about the lack of a good English-language *Ornithology*. The available texts, although each had certain virtues, were either out of date, too much devoted to applied biology (at the expense of the "science of birds"), too superficial, or, worse yet, full of mistakes. There was not a single volume one could recommend with good conscience to a student without warning him of these shortcomings. This gap in our literature he set out to fill. When Van Tyne resigned as Editor of *The Wilson Bulletin* in 1948 he already had extensive notes, and from then on he worked on the text with that painstaking attention to detail so characteristic of him. Alas, at the time of his death in January, 1957, the manuscript was not even half completed. American ornithology owes a tremendous debt of gratitude to A. J. Berger for putting aside all of his own projects in order to complete the work. Van Tyne could not have made a better choice in his collaborator, for Berger has an interest in and understanding of many diverse branches of ornithology, ranging from anatomy to behavior. The result of the collaboration is a volume of which a pre-publication reviewer has said, "I have little doubt that Van Tyne and Berger will be adopted for practically all college courses in ornithology and will also be a most useful reference for both amateur and professional ornithologists." I fully endorse this evaluation. This is a far superior volume to anything else available in the English language.

Josselyn Van Tyne was always a severe critic and of nothing more critical than of his own efforts. In a critical analysis of "Fundamentals" which the editors of *The Wilson Bulletin* asked me to undertake, I have been trying to live up to the standards set by Van Tyne. I will first give a chapter-by-chapter analysis, to be followed by a more general summary.

Chapter one is an excellent and thoroughly up-to-date treatment of fossil birds. The essential characters of the extinct types are recorded, their ecology and possible relation to modern types are discussed, but it is not mentioned how little paleornithology has added to our knowledge of avian relationships.

Chapter two, devoted to avian anatomy, is a competent presentation of the major anatomical features, thoroughly incorporating the modern literature. It contains a wealth of detail on the anatomical variation found in the various groups of birds. The treatment, on the whole, is static and descriptive and only rarely is an effort made to indicate the meaning of the differences from mammals and reptiles and the functional significance of the differences between the various families and orders of birds. A few more illustrations in this chapter would have been useful, as, for instance, one indicating the circulation of air through lungs and air sacs. There is a helpful survey of the characters generally used in avian classification. The definitions of these characters are widely scattered in the literature, and it is convenient to have them in one place. This is true, even though, as Van Tyne and Berger realized, most of these characters have far less phyletic value than claimed in the literature. Indeed, most of them may be quite valueless as indicators of relationship.

The chapter on plumage and molt is, on the whole, excellent and very informative. I myself have learned quite a few new facts from this chapter. The theorizing is, however, often shaky. The phylogenetic sequence of feather types (page 71) is certainly not generally accepted. Personally, I find very persuasive the arguments of those who, like Portmann, demonstrate that all downy feathers are secondary derivations. The dogmatic

statement of a steady reduction in the number of flight feathers (page 84) is rather questionable. Actually, the high number of secondaries in albatrosses and condors appears as much of an evolutionary advance as the reduction in the primaries among the nine-primaried birds. Having so many secondaries does not make condors and albatrosses particularly primitive. The section on bird pigments is rather poor. The interesting, unanalyzed pigments of parrots, one of which is fluorescent, are not mentioned. The section on structural colors is disorganized. What do erythrism and schizochroism do in this section? The cited explanation for iridescence is obsolete (Schmidt, Dorst).

The chapter on senses and behavior must have been the hardest chapter to write. There are so many conflicting theories and methods of approach that a synthesis would have been difficult; it was not attempted. The part on the sense organs is straightforward, but stresses anatomy too much at the expense of the senses which these organs serve. No clear picture of avian vision or hearing emerges. In the behavior part, I thought that the restricted definition of intelligence was most vulnerable.

The chapter on voice and sound production is perhaps the most original one of the volume. It is written with an evident love for the subject and brings together much scattered and hard-to-get-at information. It will surely stimulate work in this area.

Chapter six on the distribution of birds, by contrast, lacks originality and homogeneity. Zoogeography is a controversial field, and continuity of thought and consistency is lost if one wants to do right by everybody. The result is an uneven treatment. Griscom's obsolete idea that the composition of the Guatemalan birdlife is essentially a matter of glacial and post-glacial migrations is quoted approvingly (page 166), while the effects of the late Pliocene closing of the Panama gap are not mentioned. Some of the most interesting zoogeographic phenomena, such as rapid range expansions and the mixing of the North and South American fauna in Central America, are not adequately treated, while the cyclical irruptions of northern birds are treated in this chapter rather than under migrations.

An adequate treatment of the large and complex subject of bird migration in a single chapter is virtually impossible. The authors have done very well in the available space. In the section on the causes of migration, I would have liked to see a clearer separation of ultimate (selective) and proximate (physiological mechanisms) factors. In the physiology of migration, more stress should have been placed on the differences in the control mechanisms among species. Witness the difference in the control of the annual cycle of the juncos, the Emperor Penguin, and the Australian Mutton-bird. The failure in bringing previously completed chapters up to date has marred this chapter more than any other. Neither Sutter's radar observations nor Sauer's stellar navigation nor Kramer's rebuttal of Matthews' theory of homing are even mentioned. Instead, much space is given to some thoroughly discredited work. Stresemann's unique work on an annual calendar of migration is not mentioned.

Since this chapter cannot possibly give an anywhere near complete account of migration, it would have been useful to recommend a few books on the subject, for additional reading, in addition to the detailed bibliography of specialized literature.

I found chapter eight, on bird flight, rather chaotic. No clear picture of the aerodynamics of flight emerges. Important aspects, such as landing, starting, and dynamic soaring, are hardly mentioned. The emphasis in the chapter is on the equipment rather than on flight.

The chapter on food and feeding habits is informative and original. The choice from the enormous potential literature is well done. There is no excuse, however, for not incorporating into the text Schmidt-Nielsen's recent discovery of the salt glands.

Chapter 10 on breeding behavior is a well-balanced survey of this enormous field. The treatment in some areas is one-sided, such as the neglect of hole-nesting birds (with respect to territory and nest site selection), age at breeding (*Zosterops, Coturnix, Streptopelia*), size of eggs, special adaptation of tropical birds, etc. In the discussion of the "initiation of the breeding season," the treatment suffers, as in migration, from a failure of separating proximate and ultimate factors. Though numerous facts are presented, they do not lead to any generalizations.

Chapter 11 deals with social relations, a subject usually neglected by ornithologists. It is a useful survey of this subject, even though one could quibble over some of the details of treatment. Sladen's finding that adult penguins continue to recognize their young in the creches should have been mentioned.

Chapter 12 is a good summary of modern taxonomic ideas. Even controversial subjects are presented objectively and with good taste. There are some minor errors. For instance, *Dicrurus hottentottus* (page 363) is not an example of individual but of geographic variation.

Chapter 13 (with 177 pages) is by far the largest chapter of the book. It attempts to give the most important information on every one of the families of birds as recognized by the authors. The essential information on physical characteristics, geographic range, habits, food, and breeding habits are presented in about 20 lines. A single page is devoted to each family. The resulting consistency and ease of reference is bought at a price. Families with 328, 365, 375, and 398 species get no more space than the more than 20 families with a single species each. There is remarkably little consistency as to the recognition of families. Monotypic genera, such as *Leptosoma, Cochlearius, Oxyruncus, Zeledonia, Dulus, Tersina,* and *Catamblyrhynchus,* are recognized as families (as well as the Cyclarhidae and Vireolaniidae), a procedure which, although definitely defensible, would indicate a standard of fine splitting; and yet *Rupicola* is included in the Cotingidae; the Panuridae, Paradoxornithidae, Chamaeidae, and Cinclosomatidae are combined with the Timaliidae; the Pachycephalidae and Monarchinae are combined with the Muscicapidae; and worst of all, the Carduelidae are lumped with the Ploceidae; the Estrildidae are not even mentioned. All this indicates extreme lumping. Such unequal standards of family recognition must be confusing to the student. The literature references under the families are on the whole well chosen and cover the world literature, although the selection could have been better in a few families (e.g., Strigidae).

The extreme shortness of the accounts forced the authors to ignore some of the most interesting attributes of these families, particularly those concerning biology and physiology. Nothing is said on the metabolism of hummingbirds, torpidity in the Caprimulgidae, variation in parasitic habits in cuckoos, display patterns and parental care in ducks, etc. The technical diagnosis is copied from the standard literature.

Some of the special features of the volume should be pointed out. The bibliography is an extremely good introduction to the modern ornithological literature. The chapter bibliographies total 46 pages, listing about 1,300 titles. In addition, there are six pages dealing with encyclopedic and bibliographic sources, which will facilitate a further access to the literature. To be sure, the student in a small college may find only a fraction of this available to him, but at least he knows that there is more and where he can find it. Much of the literature listed at the conclusion of chapters is not utilized in the preceding text of the chapters.

There is an extensive glossary (28 pages) which could have been shorter, if some rather self-evident terms had been omitted, as, for instance, under *A*: aberrant, acute, anomalous, anterior, aquatic, arboreal, etc. Some of the terms (e.g., biome) are defined

incorrectly. The definition of the arm as the "region between the shoulder and the elbow" is peculiar to anatomists.

The proofreading has been outstandingly good. I have found only a single evident misprint. Some minor errors, e.g., misspellings for *Phonygammus, Stingelin, Bathmocercus, Regenruf, Xenophon, Lavauden*, etc., seem to be rather slips of the pen. It is a pity that the scientific names were not scrutinized by a specialist. Such inconsistencies could have been avoided as *Tchitrea* (295) for *Terpsiphone* (366, 526), *Totanus* (204, 268, 366) for *Tringa* (135), *Capella* (86, 133, 336) for *Gallinago* (112), *Charadrius* (207) for *Pluvialis* (193, 284), *Dissemurus* (304) for *Dicrurus* (505), *Grallina picata* (509) for *G. cyanoleuca* (135), *Graucalus* (504) for *Coracina* (504), *Laiscopus* (527) for *Prunella* (527), and *Gennaeus* (86) for *Lophura* (73, 421). *Muscadivores* (239) is now called *Ducula*, and *Pygoscelis adeliae* (258) is the correct spelling. The index is full and has guided me quickly to all items I was looking for. I find the absence of authors' names in the index no handicap.

Having completed the consideration of all this detail, we can now weigh the virtues and deficiencies of "Fundamentals of Ornithology." It is a volume of great competence and good balance. Containing but few outright errors, it is a volume one can rely on. It is written simply and clearly with a minimum of jargon except for descriptive anatomical terms. There is a consistent endeavor to lead the student from the very beginning to more advanced topics. Styling, typography, and proofreading are excellent. The illustrations are well chosen, and George M. Sutton's black and white drawings of representatives of 168 families of birds greatly add to the attractivenes of the the volume. The world literature is made available to the student to an unusual degree.

I have two major criticisms. One is that the volume attempts to cover too broad an area in a single volume. We know so much about birds, with thousands of workers everywhere writing monographs and research papers, that a truly up-to-date treatment of almost any subject would have to go far beyond what is included in "Fundamentals." This is particularly true for chapter 13 where the treatment is quite sketchy for most families. I wonder whether it would not be better, in a revision, to eliminate the survey of the avian families, publish it separately, and use the 177 pages gained thereby to permit a fuller treatment in the remaining 12 chapters. Van Tyne had planned the volume for the graduate student, but as it is now before us, it would seem to be closer to the undergraduate level, as also remarked by Friedmann in his review in *Science*.

My other criticism concerns the treatment as such. It is very competent, very scholarly, yet it is largely descriptive. The study of birds has to touch on so many intensely exciting things in avian biology, such as flight adaptations, control of the annual cycle, orientation, but these topics are treated in the volume with the same dryness and aloofness as the details of the skeleton. Nor is the student being made aware sufficiently of the numerous interrelations between function, habit, and structure. The biology of the bird almost invariably takes second place to the description of its structure. Little advantage has been taken of controversial subjects to excite the student. Objectivity is priced above all. Its very value as a reference work diminishes its usefulness as an exciting introduction into the life of birds.

A reviewer once said that a book could be looked at in two ways, what it is and what it could have been. It should be evident from my review that I have full praise for "Fundamentals" for what it is. It is by a considerable margin the best English-language college text in ornithology; indeed it is the best Ornithology in any language (excluding the handbooks of Stresemann and Grassé). Yet as a conscientious reviewer, I cannot conceal my feeling that there is still abundant room for improvement.—Ernst Mayr.

THE BIRDS OF ALASKA. By Ira N. Gabrielson and Frederick C. Lincoln. The Stackpole Company, Harrisburg, Pennsylvania, and the Wildlife Management Institute, Washington, D. C., 1959: xiv + 922 pp., 13 colored plates by Olaus J. Murie and Edwin R. Kalmbach, 1 fig., 1 map. $15.00.

Publication of this volume, appropriately coinciding with Alaska's rise to statehood, provides ornithologists with one of the most useful regional works on any section of North America. A great amount of distributional material has been collated by the authors. Previously published records are nicely summarized and many heretofore unpublished data are made available. The book undoubtedly will stimulate further ornithological activity in the new state.

The first 30 pages are devoted to an informative discussion of Alaskan ornithological history, beginning with the early Russian period and continuing through the "Modern Period" to 1958. This section is followed by "Some Interesting Aspects of Alaskan Ornithology" (seven pages), dealing in part with a brief analysis of the avifauna. Here we are informed that the state list consists of 321 species (or 414 species and subspecies), of which only 162 species (233 forms) are "land birds." Nine species included in the book are not discussed in field guides or other works dealing with North American birds. Three of these, the Common Crane (*Grus grus*), Gray-spotted Flycatcher (*Hemichelidon griseisticta*), and Gray-headed Thrush (*Turdus obscurus*) are recent additions not included in the fifth edition of the A.O.U. Check-List. Casual or accidental forms total 104, and 56 of these are Old World birds. Of the 13 forms termed "regular migrants" (not known to nest in Alaska), the authors list only one land bird, *Acanthis flammea holboellii*. They consider 174 forms to be permanent residents. The list of summer residents, including "a few species whose nests have not been actually found but which are almost certain to be breeders—consist[s] of 132 forms of water birds and 189 forms of land birds." However, the next statement tells us that the "total reported in this book is 306 forms of summer resident birds." The number of summer resident *species* is not given, and I find no statement of the number of forms or species positively known to breed in the state. Addition of the figures for these four categories (permanent residents, summer residents, regular migrants, and accidentals) results in 597 forms—183 more than the state's total as previously given in the text (and also in Tables I and II)!

A discussion of the highly plastic Rock Ptarmigan, Winter Wren, Fox Sparrow, and Song Sparrow terminates this section. This provides a concise summary of the trends of variation within these species, but the treatment of possible causative factors is very superficial. Some material is later dealt with in the species accounts and its repetition seems unnecessary.

The next few pages deal wth Alaskan bird migration in terms of Lincoln's flyway theory. Alaska is considered to be the "northern terminus of routes that belong to all four of the major systems" insofar as migratory waterfowl are concerned. Also treated in some detail are four "more or less unique" Alaskan migration routes: (1) an Arctic route from the Alaska Peninsula and Bering Sea islands north along the coast past Point Barrow to the breeding grounds near the Arctic Ocean, (2) an inland route from Norton Sound northeast to the Colville River and the arctic coast, (3) the Asiatic route, presumably along the Siberian coast and across Bering Strait to the Seward Peninsula (used by "North American" birds such as Sandhill Cranes and Gray-cheeked Thrushes which breed in Siberia, and by the Rufous-necked Sandpiper, Bluethroat, Yellow Wagtail, Kennicott's Arctic Warbler, and other "Asiatic" birds nesting in northern Alaska), (4) the Pacific oceanic route, traversed by certain shorebirds that breed in Alaska and winter in Hawaii and other South Pacific islands.

Alaskan ecological zones then are discussed in terms of Merriam's "life zones," of which three occur in Alaska: Arctic-Alpine (coinciding with distribution of Arctic tundra—largely north of the Brooks Range and along the Bering Sea), the Hudsonian (occupying the interior valleys plus "narrow belts around all mountains"), and the Canadian Zone (restricted to a narrow coastal strip in southeastern Alaska). More space is devoted to Nelson's concept of "faunal districts," namely the Sitkan (corresponding to Merriam's Canadian Zone), the Aleutian (southwestern Kodiak Island, the Aleutians, and Pribilofs), the Alaskan (a strip from the Alaska Peninsula along Bristol Bay, Bering Sea, and the Arctic Ocean and including all islands north of the Pribilofs), and the Alaskan-Canadian (coinciding with the Hudsonian Zone of Merriam).

Nearly 800 of the 922 pages in this heavy volume are devoted to the species accounts. The detailed descriptions of birds are "adapted or taken verbatim" from various standard works—Alexander's *Birds of the Ocean*, Bailey's *Handbook of Birds of the Western United States*, Bent's "Life History" series, Ridgway's and Friedmann's *Birds of North and Middle America*, and others. They will be useful to workers who lack extensive libraries or who prefer not to carry several bulky volumes into the field. There is no section on field recognition although this topic is occasionally dealt with under other headings. The General Range paragraphs have been condensed from the fifth edition of the A.O.U. Check-list of North American Birds. The important Alaskan Range accounts (for each species or, in the case of a polytypic species, each race) have been based on numerous sources, particularly the card files maintained by the U.S. Fish and Wildlife Service and unpublished reports from hundreds of observers.

Some of the Haunts and Habits sections contain much useful information—particularly the accounts of species with which Gabrielson has had extensive Alaskan experience. Considerable material is taken from Bent's works and other publications. At times the reader is startled upon encountering anthropomorphic phrases or sentences which are out of place and contribute nothing worth while. There are too many careless statements, some of which require re-reading before their meaning is evident. Others are not clear even then. For example, under Sylviidae, on page 676, appears the statement, "Six species or subspecies have been recorded in Alaska." One must himself count the forms, page by page, to learn that four species and two additional subspecies of this family are on the state list. Numerous paragraphs are unnecessarily long owing to poorly worded sentences and repetition of details already discussed in the descriptions. There is a separate hypothetical list at the end of the book but the same information is given in footnotes for some of these species near their regular taxonomic position. Better organization and more careful editing of the Haunts and Habits material surely would have reduced the number of pages in the volume.

Nomenclature generally follows that of the A.O.U. Check-list, but notable departures include recognition of *Riparia riparia maximilliani* (Stejneger), *Leucosticte tephrocotis kadiaka* (McGregor), and *Passerculus sandwichensis crassus* Peters and Griscom. The authors have assigned all Alaskan Gray Jays to *Perisoreus canadensis arcus*, rather than to *P. c. pacificus*, with no comment or apparent reason for their action. They also consider *Anas carolinensis* conspecific with *A. crecca*.

Vernacular names are applied to subspecies throughout the book, and no overall specific name is provided for polytypic species. This surely will confuse the already befuddled amateur who has tolerated too many haphazard changes in "common" names during the past decade. In the introductory sections one notes such names as Thayer's Gull, Green-throated Loon, and Lapland Longspur which do not appear again in the book. Some of these, listed later on as Thayer's Herring Gull or Green-throated Arctic Loon cause only temporary difficulty, but the reader cannot determine from this book that the Alaska and Lapland

Longspurs are one and the same. There are numerous other examples. *Anas crecca*, here including *A. carolinensis*, is called European Teal on page 31, Common Teal on page 159, and Green-winged Teal on page 285. The main account of *Hylocichla ustulata* is under the name of Swainson's Thrush, but there are at least two references to "Olivebacked" Thrush (pages 285 and 537). Names of this type sometimes are hyphenated on one page but not on another. A lack of consistency is likewise noted in use of the possessive in numerous vernaculars formed from men's names, e.g., Sabine Gull on page 23 but Sabine's Gull on page 462. Even the use of capital letters in bird names is not uniform.

If one considers the total number of words, there are few typographical errors in the book. However, I noted at least 13, two of which have resulted in the misspelling of ornithologists' names. In addition, several bird names are incorrectly spelled: *Picoïdes* appears without the umlaut mark, the race *arcticola* of the Horned Lark is spelled "*articola*," and *Oporornis* appears as "*Oporonis*." Holboell's Redpoll is misspelled "Holbell's" (on page 30) and MacGillivray's Warbler is incorrectly written with a lower case "g." On the poorly labelled "topography of a bird" drawing (page 52) the tail feathers are called "retrices"; the crown, pileum, and occiput are evidently considered synonymous as are bill and culmen! One would further assume from this picture that *nares* is a singular word, and that the term *scapulars* includes all of the upper wing coverts.

The other illustrations are not in keeping with the scope and importance of the book. There are no photographs and the single small map is inadequate. The color plates, depicting 52 species, are poorly reproduced—a trait seemingly characteristic of many recently published American bird books. In my copy three plates are badly out of register and others are lacking in clarity. Such careless work is inexcusable in a publication of this sort—and at this price. The text description of McKay's Bunting does not agree very well with the birds figured on plate 13—strangely situated facing page 338, among the shorebirds.

Two outstanding features of the book are the gazetteer (compiled by Myra A. Putnam) and the admirable bibliographic list. The authors endeavored to "compile a bibliography of Alaskan Ornithology that would be as complete as possible." The result is 55 pages and approximately 1,010 titles, suggesting that they have at least come close to their objective. I noted only one minor discrepancy between a text reference and the corresponding title in the bibliography.

The tremendous amount of work involved in the preparation of this volume probably never can be fully appreciated by anyone but the authors, for whom the project was entirely a "labor of love" undertaken in spare hours at home for several years until more time became available. It is a major contribution to regional North American ornithology, and most of my criticisms deal with points which will not seriously limit the usefulness of the volume to ornithologists. But it is a pity that a work of this magnitude, one surely to be used by scores of workers for years to come, must be marred by inferior illustrations, and by minor errors, confusing vernacular nomenclature, and loose statements which could have been easily corrected.—Dale A. Zimmerman.

Living Birds of the World. By E. Thomas Gilliard. Doubleday and Co., Inc., Garden City, New York, 1958: 8½ × 11 in., 400 pp., approx. 400 photographs, 217 in color. $12.50.

Mr. Gilliard, of the American Museum of Natural History, and his publishers have produced a book of which they may be proud. The text is an impressive summary of the general biology of the birds of the world, reflecting the wide experience, in the field and in the literature, of the author. Equally valuable is the array of photographs—over half in color—illustrating most (but not all) of the families of birds. The photographs are mostly good, many are excellent, few are poor. To Americans, who have become accustomed to mediocre

or poor color reproductions in recent picture books on birds, Gilliard's volume provides a refreshing change. The fidelity of color and register are better, in my opinion, than in any comparable American bird book of recent years.

The book opens with a brief introductory chapter describing some accomplishments of modern ornithology. Then follows a chapter on fossil birds which, while interesting, leans to the sensational approach and fails to do justice to the known fossil record. Most of this chapter deals with Jurassic, Cretaceous, and sub-Recent birds, the entire Tertiary being disposed of in one inadequate paragraph.

Starting then on page 17 is the family-by-family account of the living birds of the world. This is the important part of the book and here Gilliard has done an outstanding job. For each family the following topics are usually treated, in a narrative fashion: distribution, number of species, general description, methods of flight and feeding, habitat, behavior, and breeding biology. In small families all species are usually mentioned by common and scientific name and briefly described, with geographic range. In larger families, well-known species, "typical" species, and unusual species are often singled out for discussion. Any book as packed with information as this one is sure to have some inconsistencies and errors. These errors and misleading statements are especially frequent in the part of the family accounts mentioning descriptive or biological particulars of various species. I have the feeling that many individual species are mentioned in a superficial attempt to give the appearance of broad coverage (and perhaps to back up the dust jacket's unjustifiable claim that "1500 species [are] described"). It would be misleading to dwell on these numerous and mostly trivial errors because for the most part the family accounts are both readable and reliable.

Major taxonomic problems at family level are usually mentioned, in lay terms, and the classification used follows Amadon's "sparrows-last" sequence for the Passeriformes, and Wetmore's classification, with some modifications, for other orders. Gilliard lists 12 subfamilies in the table of contents. Eight of them (Cochleariinae, Pedionominae, Oxyruncinae, Pseudochelidoninae, Regulinae, Hypositttinae, Cyclarhinae, and Vireolaniinae) have previously been regarded by some authors as full families and are given the same treatment in text as families. The remaining four subfamilies belong to Fringillidae, and no special heading or format distinguishes them in the general discussion of the family. The subfamilies Cyclarhinae and Vireolaniinae are listed in the table of contents as subheadings after the family Nectariniidae and the accounts in text follow this family. This is confusing, to say the least, because Gilliard really considers them to be subfamilies of the Vireonidae, the next family in the sequence, as is clear on reading the text.

Many copies of this book will be sold for the pictures it contains. As already mentioned, these are of good quality. Many show behaviorisms not usually pictured. Happily, many depict birds in flight, often at a distance, and are a refreshing change from the standard short-range portrait. I notice two color photographs that are misleadingly labeled—the "Yellow-shafted Flicker" female lacks the red nuchal collar of that species; it apparently is a hybrid between that species and the Red-shafted Flicker. The "male" European Blackbird, if indeed a male, is certainly much browner even than ordinary year-old males. Some figures are poorly reproduced. In my copy these are Pygmy Nuthatch (shown as green and blue); Silver-beaked Tanager, Crested Tanager, and Blue-gray Tanager (out of register); female Pyrrhuloxia and Saffron Finch (fuzzy). For the most part, however, the figures are well chosen and faithfully reproduced. As examples, I think that the Common Tern, the Roadrunner, the Short-billed Marsh Wren, and the Painted Buntings in flight are as good as one could hope for. Illustrations are lacking for some three dozen of the 164 families recognized. Probably no photographs are available for many of these families. Surely, however, this is the most comprehensive photographic coverage of world birds yet produced. It irritates me

not to be told which pictures represent captive birds; it seems unfair to the photographers whose pictures were taken in the wild. Most of the in-captivity photographs can be identified as such by close study. Also, most of them are fairly good and probably often represent species not otherwise photographed. One notable failure, however, is the full-page black and white photograph devoted to two frazzled, cage-worn Quetzals, which scarcely live up to the text's justifiable billing of this species as "as gorgeous as a bird of paradise." The color photos by H. Ruhe and T. Roth all seem to be of captive, often disheveled, birds. North American and European birds are represented, as one would expect, by usually excellent photographs taken by several dozen skilled photographers. On the other hand, the numerous good pictures of wild birds from South America, Africa, Australia, and Asia are pleasant surprises.

All in all, Gilliard's book is one which amateur and professional bird students will find useful and authoritative.

Many persons still feel that any book costing over $5.00 is expensive. Gradually, however, it is becoming inescapably clear that *all* printing is now expensive, and colored plates especially so. Viewed this way, the price of $12.50 for this lavishly illustrated, handsomely produced book seems reasonable. There is also a British edition, printed in the United States and published by Hamish Hamilton Ltd., London, which is identical in text and plates to the Doubleday book but has a cheaper, less sturdy binding. The price of the British edition is £3 10s., or $9.80.—HARRISON B. TORDOFF.

INDEX TO VOLUME 71, 1959

This index includes, in addition to names of species and authors, references to the following topics: behavior, food habits, fossils, hybrids, measurements, migration, molts and plumages, nesting, parasitism, physiology, populations, predation, taxonomy, voice, and weights. Also included are references of biological significance to mammals, reptiles and amphibians. Names of new forms described in this volume are printed in **boldface** type.

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